Railroad Age Gazette

Including the Railroad Gazette and The Railway Age

PUBLISHED EVERY FRIDAY BY
THE RAILROAD GAZETTE (INC.), 83 FULTON STREET, NEW YORK.

CHICAGO: 160 Harrison St. PITTSBURGH: Farmers' Bank Bldg.
LONDON: Queen Anne's Chambers, Westminster.

W. H. BOARDMAN, *President and Editor.*
S. A. SIMMONS, *Vice-President.* RAY MORRIS, *Sec'y and Man'g Editor.*
R. S. CHISOLM, *Treasurer.*
The address of the company is the address of the officers.

Subscription, including regular weekly issues and special daily editions published from time to time in New York, or in places other than New York, payable in advance and postage free.

United States and Mexico.....$5.00 a year
Canada.....$6.00 a year
Foreign Edition, London.....£1 12*s* ($8.00) a year
Single Copies.....15 cents each
Entered at the Post Office at New York as mail matter of the second class.

VOL. XLVI., No. 9. FRIDAY, FEBRUARY 26, 1909.

CONTENTS

EDITORIAL:

Side Door Subway Cars..... 391
First Report of Nebraska Commission..... 391
Piece Work Rate Making..... 391
The Illinois Commission..... 392
Open Hearth Steel Rail Manufacture..... 392
Interstate Commission on Rate Questions..... 393
Mixing Anthracite and Bituminous Coals..... 394
New Publications..... 394

ILLUSTRATED:

High Steam-Pressures in Locomotive Service..... 403
Rebuilding the Cairo Division of the Big Four..... 408
Brake Shoe Testing Machine..... 416
Experimental Side Doors in the New York Subway..... 418
A Unique Excursion Car..... 420

LETTERS TO THE EDITOR:

The Unit in Railway Operation..... 395
Qualifications of a Rear Flagman..... 395
Flat Spots on Car Wheels..... 396
Wanted: Railway Statesmen..... 396

MISCELLANEOUS:

Manual Block Signaling with the "A B C" System on Nor. Pac. 398
Electrification of Melbourne Suburban Lines..... 402
Electrification of the Southern Pacific Suburban Lines..... 406
Railway Brotherhoods and Discipline..... 407
The Smoke Nuisance in Cities..... 412
Pooling of Freight Cars in Germany..... 415
Car Efficiency and Car Surplus..... 419
Steam and Trolley in Connecticut..... 419
Train Accidents in January..... 421
Freight Traffic on the Illinois Traction System..... 421
Purchase of Railway Coal..... 422

Foreign Railway Notes:
Railways in the Earthquake..... 397
Railways in Southwest Africa..... 407

GENERAL NEWS SECTION:

General News..... 423
Traffic News..... 427
Railroad Officers..... 433
Railroad Construction..... 435
Railroad Financial News..... 436
Equipment and Supplies..... 437
Supply Trade News..... 438

The double side door train experiment in the New York subway during the past week has already proved what seemed obvious when Bion Arnold submitted detailed drawings to the Public Service Commission a year ago. An engraving on another page shows the position of the additional door for outgoing passengers, and its relation to the vestibule door for entrance. Mr. Arnold's plan for using compressed air power is not installed in this trial train, with the result that the hard-worked guards have to do more than double work in moving the doors, and their hostility to the innovation was assured. Indiscreet public statements by the General Manager added to the early difficulties in getting fair play. Nevertheless, the improvement is remarkable. It has been just possible to pass thirty trains an hour through a station. That is the limit. The reduction in time of unloading and loading points the way clearly to an increase in train capacity of one-third. The traffic is growing at such a rate that the added capacity will quickly bring a partly proportionate increase in earnings. With pneumatic door-movers, the guard's work will be less for four doors than it is now with two, so that he can give more attention to the safety of passengers. The present method of holding back incomers by vociferations, "Let 'em off first," sometimes by force from the platform guard and frequently with football tactics by the passengers, is a rowdy performance. It makes women abhor the subway, lessens income, and by so much fails in proper performance of public service.

In their first annual report, the Nebraska Railway Commissioners naively remarked: "Much time was consumed during the first year of the Commission's existence by the formulation of a system of reports, laying out routine office work, and gaining familiarity with the technical details of railway express and telephone business." Probably quite a number of the traffic managers of the railways in this country would be inclined to think that it took them rather more than 12 months to become familiar with the technical details of railroading, or even with the technical details of the branch of railway business that deals with rate making. Of the three Commissioners, one was a physician and the other two lawyers before they started to learn the details of railway business. In company with a good many other State commissions, the Nebraska Commission asks for added power. It also asks for physical valuation of railway property in the state, valuation to go on perpetually. It is acknowledged to be expensive, the expense, of course, being borne by the taxpayer, who presumably would rather spend his money in this wholly unproductive way than to use it to encourage railway building in Nebraska. In a complaint brought before the Interstate Commerce Commission by the State Commission of Nebraska, rates on coal from points in Wyoming were attacked and the Interstate Commerce Commission ordered a reduction. Attempts by State Commissions to have interstate rates to and from points in their own state reduced is a tendency in the regulation of rates by State Commissions that apparently will become more marked as the commissions begin to learn something of the competition between different territories and between different markets. It will give a political motive for a State Commission to try by any means in its power to have rates reduced into its state. In one paragraph of the report the Commission plainly exults in its good work. "Illustrative of the value of the statutory provision [that the railways cannot raise rates without the permission of the Commission] may be cited an attempt by the railways during the summer of 1907 to increase the minimum charge on small freight shipments from 25 to 40 cents. This was prevented by the Commission, although the increased rate was made effective in adjoining states and on interstate traffic."

The substitution in any shop of a piece-work system for an existing time system necessitates establishing a more or less elaborate scale piece-work rate to obtain for the various operations about the shop. These rates necessarily differ according to the local condition of wages and shop appointment, but in any one shop they bear some definite relation to the wage paid under the time system. It is to be borne in mind by the shop management and also impressed upon the mind of the workmen, that a change from the day wage to the piece-work plan is not being instituted in an attempt to increase production without an increase in the wages of the workmen. Co-operation of the man on a machine is vital to the efficient working of the piece-work plan. There is another consideration to be accounted for if a piece-work basis is to continue; that of a possible lowering of a rate when a mechanic attains

skill sufficient to increase his earnings above what is considered a maximum. We have in mind a condition which existed several years ago in a railway shop where the machinists working in the rod gang were able, on a piece-work basis, to make a wage which exceeded the day rate upon which the piece-work rate was based. The result was that the men did not always turn in all the cards for work completed, but only enough of them to get credit for the standard day's work, fearing that the evidence of higher earning power would result in cutting the piece-work rates. In this connection the plan in force at the West Albany shops of the New York Central & Hudson River is interesting. A piece-work rate once fixed will not be altered by the shop management, unless a new method be devised for doing the particular piece of work, notwithstanding the fact that a mechanic may become so skilled as to make a total day wage far in excess of that upon which the piece-work rate was based. An instance in point is that of a rate for finishing, to the pop marks, shoe and wedge wearing faces, which was based on clamping the casting to the planer bed. This rate stood until a chuck was devised which permitted the shop management to make a new rate. A piece-work basis thus guaranteed has at least two good effects: the mechanic puts forth his best efforts, without fear of rate-cutting, for his personal gain, and shop foremen and inspectors are ever on the lookout for more efficient methods.

Governor Deneen is seeking legislation to enlarge the authority of the Illinois Railroad Commission. Among other things he desires the commission to be given control of issues of securities of railways similar to that exercised by the Public Service commissions of New York. It is not surprising that such legislation should be sought in the state where the "Alton deal" was put through. But has it never occurred to Mr. Deneen that it might be well for him to perform his duty as a public officer before he seeks the creation of additional machinery to force the managers of railways to do their duty? The personnel of the Illinois Railroad Commission has been changed since Mr. Deneen became governor. He had a chance two years ago to appoint as commissioners men who had special fitness for their work. He did not take advantage of the opportunity, but appointed a lawyer, a lawyer and newspaper man and a manufacturer, all of whom are politicians. Each is a man of good ability, but none knew much about railway matters. To do work that requires experts Mr. Deneen chose men who were totally inexpert, and who, as they have not attended very closely to business, are probably about as inexpert now as when they were appointed. To regulate the large mileage of railways in Illinois he chose men whose knowledge of transportation matters was gained chiefly in the field of politics. Why, instead, did he not appoint, for example, an experienced railway man, a competent economist or a man experienced in traffic matters from the shipper's standpoint and a lawyer? Having appointed commissioners who know little about the condition and needs of the railways, he proposes that they shall be given power to control the issuance of securities by directors, who may reasonably be assumed to have a pretty full knowledge of those conditions and needs. Mr. Deneen's course indicates that in Illinois, as in a good many other states, a radical policy of regulation of railways is being advocated, not for public, but for political purposes. In New York when a 2-cent fare bill was passed without regard to its merits, Governor Hughes courageously vetoed it because he thought such action was unfair. In Illinois when a 2-cent fare bill was passed Governor Deneen questioned its fairness, and then signed it. Governor Hughes, whatever may be said of his railway policy, at least honestly favored regulation for public purposes, and thwarted those who tried to use it for political purposes. Governor Deneen might profitably imitate Governor Hughes' public spirit and courageous fairness while seeking to get the legislature to imitate the legislation the New York executive has had enacted. Intelligent, fair, faithful officers to administer the laws are surely as important as stringent statutes. If the Governor of Illinois had appointed the former, regardless of political considerations, he would be less open to the suspicion of seeking the latter mainly because of political considerations.

OPEN HEARTH STEEL RAIL MANUFACTURE.

On account of the general interest in the manufacture of open hearth steel rails and the large orders which are being given by the railways for this quality of steel, it is interesting to know about what may now be expected from the steel works in the United States for rolling open hearth rails. A letter from A. I. Findley, editor of *The Iron Age*, gives the following, which will assist in making an approximate estimate:

"There are three mills which roll only open hearth rails, and their capacities are definitely scheduled in the directory of the American Iron and Steel Association as follows: Indiana Steel Company, Gary, Ind., 750,000 tons per year; Tennessee Coal, Iron & Railroad Company, Ensley, Ala., 600,000 tons per year, and Bethlehem Steel Company, South Bethlehem, Pa., 300,000 tons per year.

"At Youngstown, Ohio, is the Ohio plant of the Carnegie Steel Company, including the rail mill with a capacity of 600,000 tons a year. Heretofore only Bessemer rails have been rolled at this plant, but a group of open hearth furnaces has been completed recently, with a rated annual capacity of 420,000 tons. The Pennsylvania Steel Company at Steelton, Pa., has an open hearth plant with a rated capacity of 485,000 tons of ingots per year. The rail mill connected with the same plant, which has heretofore run almost entirely on Bessemer rails, has a capacity of 300,000 tons a year. Much of the open hearth steel at this point goes into products other than rails. At Johnstown, Pa., the Cambria Steel Company has a rail mill which has always rolled Bessemer rails; the open hearth plant of this company is about 1½ miles distant from the rail mill, and its open hearth steel goes largely into plates. The Lackawanna Steel Company has an open hearth plant at South Buffalo, having a capacity much smaller than that of the Bessemer plant, the product of which latter is converted almost entirely into rails. The open hearth steel made at South Buffalo is rolled into plates, structural and bar steel. Similarly at South Chicago, the Illinois Steel Company makes open hearth steel, but it is all intended for the plate mill. The capacity of the Colorado Fuel and Iron Co. is 360,000 tons.

"It would be misleading to say that any of the rail mills named above would produce in any year up to their rated capacity. At Ensley, for example, the open hearth capacity is 450,000 tons of ingots a year, as the original ten open hearth furnaces are not operated and probably never will be, the entire dependence being on the new open hearth plant. Some of the open hearth steel is shipped as billets. At Gary, in view of the billet, structural, universal and merchant mills, it is quite unlikely that there will ever be, in ordinary distribution of business, sufficient steel available to permit of running the rail mill to full capacity. At Bethlehem the structural mill is an important factor, and there is neither pig iron capacity nor open hearth steel capacity sufficient to permit of running the rail and structural mills simultaneously to their full capacity. At Youngstown there are merchant mills to which a portion of the open hearth steel capacity would be devoted. Therefore, 420,000 tons of open hearth rails would not be rolled in any year at that plant. The difficulty of estimating the available open hearth capacity is due to the fact that so many plants are unbalanced, some not having pig iron capacity equal to finishing capacity and others not having steel ingot

capacity adequate to the simultaneous operation of all the finishing plants."

Taking the above figures and conditions of manufacture as explained, an approximate estimate of the steel works in the United States for turning out open hearth rails would be about as follows:

Tennessee Coal, Iron & R. Co.	400,000 tons.
Indiana Steel Co., Gary	600,000 "
Bethlehem Steel Co.	200,000 "
Youngstown (Carnegie)	300,000 "
Pennsylvania Steel Co.	250,000 "
Colorado Fuel & Iron Co.	250,000 "
Total	2,000,000 tons

The maximum production of steel rails in the United States, both Bessemer and open hearth, was reached in the year 1906, when 3,977,872 gross tons were produced, and the total in 1908 was 1,921,540 tons. It will thus be seen that the present capacity for production of open hearth rails is about equal to the total production in 1908; also that the present open hearth capacity is about 50 per cent. of that of the total requirements for rails in prosperous years.

INTERSTATE COMMISSION ON RATE QUESTIONS.

The parts of the commission's report in which it discusses traffic matters do not sound like the utterances of a body whose main duty is to arbitrate judicially and impartially between railways and shippers. They sound like a statement from a shipper's bureau.

The commission says it "feels that to require the shipper to ascertain for himself at his peril the rate imposes upon him an undue burden"; that the railway "may fairly be required to state in writing, when a written request is made by the shipper, the rate which it has published and maintains in force"; and calls "special attention to this matter as one of immediate and general concern, which discloses the need of an appropriate remedy." In its decision in the case of A. J. Poor *v.* C. B. & Q., *et al*, decided July 8, 1907, the commission said: "To permit shippers to impute negligence to carriers in quoting rates and on that ground to enjoy the rate quoted * * * would open a broad and ample way for the payment of rebates." Since the decision in the Poor case the National Industrial Traffic League and other shippers' organizations have insistently demanded a change in the law that will let shippers "impute negligence to carriers in quoting rates," regardless of the fact that this "would open a broad and ample way to rebating." Has the commission changed the views expressed in the Poor case, or would it rather "open a broad and ample way for the payment of rebates" than oppose the demands of shippers?

The commission renews its petition for legislation to empower it to restrain advances in freight rates, pending inquiry into their reasonableness. It bemoans the hardships shippers suffer because "railways may establish whatever interstate rates they choose" and "no proceeding can be begun before this commission until the schedule establishing the rate has been filed" and lays down the dictum: "No carrier should be required to reduce its rates without a fair hearing, neither, in our opinion, should the public be required to pay advanced rates without opportunity for a fair hearing." The railways are large purchasers of commodities. The commission no doubt thinks it is no hardship for them to have to pay advanced prices for lumber, coal, etc., "without opportunity for a fair hearing."

In fact the Commission assumes in the recently decided case of Shippers & Receivers' Bureau of Newark v. New York, Ontario & Western, that an increase in the cost of labor, and in the price of railway materials and supplies, does not necessarily imply a decrease in the net earnings of a carrier or preclude the possibility even of an increase in its net earnings, due to an increase in the volume of its traffic or to a decrease in the ratio of its operating expenses to its operating revenues; nor is an increase in the cost of labor and materials, accompanied by a decrease in the net revenues of a carrier, necessarily inconsistent with the possibility that its net earnings may still suffice to afford it a fair return on the investment without an increase in its rate schedules.

But if the man who sells the railways lumber or coal has to pay an advance in freight rates before a paternal government has ascertained that the advance is fair it is a great outrage. In other words, when the investor puts his capital into private property devoted to the service of the public he properly loses, the commission thinks, the right that the owner of private property not devoted to the service of the public enjoys to have something to say about what he shall be paid for the use of his property.

This is the opposite of the principle of previous legislation regulating interstate commerce. The original Act to Regulate Commerce, the Elkins Act and the Hepburn Act recognize and confirm the right of the railways to initiate all interstate rates. The rates they fix are *prima facie* reasonable. If their reasonableness be questioned judicially, the presumption of right acting follows the carriers through the proceedings. The legislation the commission asks would, in effect, reverse all this, and put on the carrier the burden of proving that any advance it sought to make in its charges for its services was reasonable.

The Railroad Commission of Wisconsin, in its personnel one of the strongest commissions in the country, has substantially the same power over interstate rates that the Interstate Commerce Commission has over interstate rates. In its annual report for 1908 the Wisconsin Commission also discusses the proposition to require railways to get permission from regulating authorities to advance rates, and says: "The merits of such a plan deserve careful consideration. It is clearly complicated with grave objections. We have serious doubts regarding its feasibility or practicability." There are several reasons for believing the proposed federal legislation would be unconstitutional. Suppose after it were enacted, that a railway sought to advance a rate; that the commission restrained the advance; and that after protracted litigation the courts found that conditions had made the rate sought to be advanced unremunerative. From the time the commission's order restraining the advance went into effect it would have compelled the railway to handle the commodities affected at a loss. The railway would be unable to get reparation from the shippers who for the months or years the proceeding was pending used the confiscatory rate; while as the law now is a shipper who has been charged an excessive rate can get reparation.

While the commission is moved by sympathy for the shipper who may now have temporarly to pay an excessive rate, for which he can later get reparation, it has nothing to say about the irreparable confiscation of the property of the railway that might take place under the legislation it proposes. Perhaps it assumes that its judgment as a traffic manager is so infallible that it never would unjustly suspend an advance. The courts probably would not regard the matter in this light. They would probably hold unconstitutional a law that would empower an administrative body to prohibit changes in rates under conditions that might inflict losses on railways that no judicial review could repair. It would seem that the only way the plan to have the commission restrain advances could be made constitutional would be to require shippers to give bond to pay the proposed higher rates if commission or courts should ultimately hold them reasonable.

The commission's report constitutes a strong argument for separating its administrative and quasi-judicial functions. In his important address before the American Bar Association at Portland, Maine, in August, 1907, Commissioner Prouty said:

"It has been in the past one of the most serious reproaches against that (Interstate Commerce) act that the Commission was made by its terms a prosecuting officer and judge . . . While the orders of the Commission were unimportant and subject to review in the courts, the union of these two functions may have been well enough. . . . The jurisdiction of the Commission has been enormously increased, and its decision with respect to most of the matters that it hears is, in my

opinion, practically final. I feel, therefore, that the time has come when the duties of this body should be separated. . . . I very much doubt whether the same body can properly discharge both these functions. In the end it will either become remiss in its executive duties or will, in the zeal of these, become unfit for the dispassionate performance of its judicial functions."

The condition that Mr. Prouty foresaw seems to have come. The tone of its annual report seems to show that the commission, in the zeal of its executive duties, is growing unfit for the dispassionate performance of its judicial functions. The feeling of the railways that the commission is growing more antagonistic to them is reflected in the statement in its report that prior to July 1, 1908, only one suit had been filed to set aside its orders, while since then 16 such suits have been filed, "and few orders of much consequence have been permitted to go without contest." How can the railways be expected o think that the commission will perform its judicial functions fairly—how can they be expected to acquiesce in its demands for greater powers—when it commits the gross impropriety of arguing in its report against the reasonableness of advances in rates upon which it will later, in 'ts judicial capacity, be called to pass judgment? Probably we can never have a rate tribunal whose wisdom and impartiality will command or deserve the confidence of all interests until we cease to pass laws making the same body both prosecutor and court.

MIXING ANTHRACITE AND BITUMINOUS COALS.

The use of bituminous coal for locomotive fuel by railway companies which are large producers of anthracite coal, and whose lines are flanked by enormous piles of the finer sizes which do not find a ready market, may seem to be an illogical practice, but it is well sustained by economical operating results. The larger sizes of anthracite do not burn rapidly and the spaces between the lumps admit such large quantities of air that the gases are cooled; the rate of evaporation is low and the capacity of the boiler is much less than when soft coal is used. The smaller sizes of anthracite contain a large percentage of ash, as much as 15 to 20 per cent.; the fine coal packs the grate, so that sufficient air is not drawn through for rapid combustion, and again the capacity of the boiler is much reduced. It follows that for fast passenger service, when high steaming capacity is required, it is necessary to use the chestnut or stove sizes of anthracite; but these are the grades most in demand for domestic use and the price is too high for locomotive work. The rate of combustion of the better grades of anthracite is only 50 to 60 lbs. per sq. ft. of grate per hour, and this rate cannot be materially increased, even with a heavy blast and a high vacuum in the smokebox, and it is necessary to use a grate of unusual width in order to get sufficient boiler capacity. This difference in what might be called the physical qualities of anthracite and bituminous coals has naturally suggested the mixture of the two for locomotive fuel, and in point of fact for the smaller sizes of anthracite this is found to be the best method of burning the coal in locomotive boilers. The calorific value of the soft coal being high, a sufficiently hot fire can be maintained, in spite of the loss due to the high percentage of ash in the hard coal, and the more rapid disintegration of soft coal creates spaces in the coal bed for the freer admission of air than would be possible with a closely packed bed of fine anthracite alone. It is, of course, well known that the anthracites are older deposits than the bituminous coals and have been subjected to pressure and the coking process for a longer period, until the volatile matter has been well-nigh eliminated. The best steam coals are found between the two, as in the Welsh or the semi-bituminous coals like those of the Pocahontas seam of West Virginia, which is usually regarded as belonging to the same epoch as those of the Pottsville mines of Pennsylvania, but not so thoroughly coked.

Theoretically, then, it would seem that the most efficient mixture of anthracite and bituminous coal would be one in which the chemical compositon of the whole would approximate that of good Pocahontas or Welsh coal. This is, however, quite difficult to obtain because of the low percentage of ash which these coals contain, so that for practical work the relative proportions of fixed carbon and volatile matter is about the best that can be attained. For example, high-grade Pocahontas coals may analyze as follows:

Volatile matter	17.43 per cent.
Fixed carbon	77.71 "
Ash	4.63 "
Moisture	.23 "
	100.00 per cent.

An average analysis of Lehigh coal would be:

Volatile matter	3.08 per cent.
Fixed carbon	86.38 "
Ash	5.92 "
Moisture	4.62 "
	100.00 per cent.

Of Pittsburgh a fair average would be:

Volatile matter	41.15 per cent.
Fixed carbon	50.88 "
Ash	7.00 "
Moisture	.97 "
	100.00 per cent.

It will be seen at once that no possible combination of two coals containing 5.92 and 7.00 per cent. of ash, respectively, could result in a mixture containing but 4.63 per cent. But it is quite possible to make the relative proportions of volatile matter and fixed carbon approximately the same. In Pocahontas coal this is as 1 to 4.46; in the Pittsburgh as 1 to 1.12, and in the Lehigh as 1 to 28.04. By mixing these coals in equal proportions the resulting mixture would have a ratio of volatile matter to fixed carbon of about 1 to 3.33.

For practical working it would, of course, be impossible to analyze all coals, nor would it be economical to use the high grades of Lehigh and Pittsburgh coals, and, therefore, approximate results only are obtained. In one case for freight service a mixture of one-half No. 2 buckwheat coal and one-half run-of-mine bituminous coal is used, neither, of course, having a very high chemical value, and this is not followed very closely, and no attempt is made to make comparisons with the higher grade coals. Ash must be higher than in the ideal conditions, and even the proportions given have to be varied when the supply of bituminous coal runs short, when two parts of anthracite to one of bituminous is often used.

On other roads no attention whatever is paid to the matter, and any mixture that will work is used, probably with a corresponding lack of economy, while in still another case just enough soft coal is added to keep certain grades of anthracite from clinkering, and this is accomplished by the use of anywhere from 5 to 35 per cent. of soft coal added to the buckwheat. In this case the anthracite is loaded into the tender and the soft coal dumped on top, and the two get well mixed by the fireman simply shoveling in through the pile, a little soft coal coming down with each shovelful. Any available grades of the two kinds of coal are used and a fairly good steam fuel results.

This looks a good deal like haphazard chancework, and it is; and the fact that such crude mixtures do so well indicate that far better results would be obtained if more care were to be taken in the examination of what is used and then a corresponding amount of pains were to be taken to see that they were mixed in proper proportions.

NEW PUBLICATIONS.

The Temperature Entropy Diagram. By Charles W. Berry. New York: John Wiley & Sons. 299 pages; 5 in. by 7 in.; 108 illustrations. Cloth. Price, $2.00.

This book, whose author is a professor of mechanical engineering at the Massachusetts Institute of Technology, is essentially a mathematical treatise and consideration of the entropy diagram from cover to cover. There is little that

can be read as a book is ordinarily read. It must be studied and carefully studied in detail else it will be impossible to follow the processes that are given. The book was prepared for the use of students in thermodynamics, and the author states that an attempt has been made to bring together the data that is ordinarily only to be found scattered through a number of treatises. Although professedly not intended for the advanced student it will be evident at the first glance that it will be useless in the hands of one who has not already made some progress in the study, in fact even in the introduction the language presupposes a considerable knowledge of thermodynamics in order that it may be read understandingly.

The first chapter opens with a discussion of the general subject and this is followed by a consideration of the diagram for perfect gases, saturated steam and superheated vapors, including one for the flow of fluids, and then passes on to the work of hot air, gas and steam engines and air compressors. Naturally it is theoretical in the extreme since otherwise there would be no basis for the premises upon which the mathematical deductions are based. For example, in discussing the point of maximum efficiency of an engine it is shown that that condition cannot be obtained unless all of the heat is received at the upper temperature and rejected at the lower temperature under consideration, a state of affairs that it is quite out of the question to meet in any steam engine practice, although Diesel has attempted to realize it as nearly as possible in his internal combustion engine.

The book under review is a second edition that has been revised and enlarged in which there is a more extended application of the temperature analysis than was attempted in the first edition.

American Railway Transportation. By Emory R. Johnson, Ph.D., Professor of Transportation and Commerce in the University of Pennsylvania. Second revised edition. 434 pages; 5 in. x 7½ in.; with numerous illustrations. Cloth. Price, $1.50. D Appleton Co. 1908.

The second revised edition of Professor Johnson's well known work is accounted for by the rapid progress made by American railways during the past five years, and the extraordinary amount of regulative legislation enacted by the states and the federal government. Professor Johnson has done his work in his accustomed thorough and painstaking manner, and the book at hand presents a perfectly astounding storehouse of material, carefully sub-divided and well indexed, with copious references for further investigation. The compilation of so great a mass of facts, not all easy to obtain, in this careful and scholarly manner, is a work deserving of the highest praise. The objection may be raised that the making of an economic history by the collection and classification of numerous disconnected facts may obscure a clear view of the situation as a whole, just as trees, individually and collectively, are apt to spoil the view of a forest! But in a period where careless economic thought and statement is prevalent, it is refreshing to find an author who admires facts and sets about the acquisition of them in a systematic manner. Professor Johnson does this and more too, in his "Railway Transportation."

A Congressional History of Railways. Vol. 1. Congress and the Railways down to 1850. By Lewis H. Haney, Ph.D., Assistant Professor of Economics, State University of Iowa. Reprinted from the Bulletin of the University of Wisconsin, Economics and Political Science series, vol. 3, pages 167-430.

"In six distinct ways the government tended, or actually came to regulate railways: (1) As sovereign in the District of Columbia; (2) as supreme authority in the territories; (3) as proprietor of public lands; (4) as distributor of the nation's mails; (5) as provided for the public defense; (6) as an investor of aid to railways."

The Congressional History of Railways in the first volume traces this regulation from the earliest proposals to build a railway down to 1850, treating the history both chronologically and by subjects. The legislation both proposed and enacted that affected railways is dealt with, and an attempt has been made to throw light on the present problem of the relation of the government to railways by showing how this problem has been handled in the past and what the results of such and such methods have been.

In this respect the results obtained in the first volume are negative rather than positive. The study of the history of past problems tends to show that the present problem is a different question entirely than any one faced by congress previously. As the author points out in dealing with individual acts of legislation in the first half of the nineteenth century, each act, or proposed act, has to be studied by itself or in connection with other political and economic forces at work in that period rather than in connection with other acts of legislation on the same subject proposed or carried out at a different time and under other circumstances.

The work is admirably arranged for reference. Each chapter has an introduction and a concluding summary. The index is good and the appendices are well selected and valuable, but the book as a whole is not particularly readable. The style is redundant, making the work when read consecutively rather tiresome.

The material was gathered largely from congressional records and other official sources, and full reference is made to these sources in foot notes, which should be of great help to a student of history.

The history of the railway period prior to 1850 might be summed up by saying that regulation of railways, during that time, was proposed rather than enforced, and the principles of land grants in aid of railway building were established, but by 1850 had not been very largely acted on.

Letters to the Editor.

THE UNIT IN RAILWAY OPERATION.

Richmond, Va., February 23, 1909.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I was glad to see the editorial in your issue of Feb. 12 under the above caption, and hope it will lead to better methods in making comparisons of the results of railway operation than what you call "the fetich of the operating ratio" and the "big trainload."

There is no single unit of service by which to measure the cost of transportation on a railway, but the nearest approximation to one is the *gross ton-mile;* and it seems to me that the importance of keeping an accurate account of the gross tonnage, as well as the train and car mileage, must sooner or later be generally recognized.

It may not be possible to separate the expenses dependent upon train mileage, car mileage and gross ton mileage with exact precision, but a close approximation to exactness is attainable and will give the cost of each of these three separate units of service, upon the combination of which in varied proportions the cost of movement per train mile chiefly depends.

T. M. R. TALCOTT.
General Manager, Tidewater & Western.

QUALIFICATIONS OF A REAR FLAGMAN.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

S. G.'s article on flagging prompts me to call attention to some defects in our flagging methods, not only on the road in question, but on many others as well. The flagging methods in actual force are in my judgment the weakest link in the operating chain.

I frequently ride at night between New York and the West.

It is not unusual to find the flagman, after the smoking room is vacated by the passengers, say, by midnight or later, comfortably dozing—and who knows but he is asleep? He is in no position, when aroused, to realize the promptness or speed with which he should hasten back in the event a flag is necessary. All passenger trains at least should have a seasoned man, with a good heart and lungs and limbs for flagman, and his duty should be exclusively to protect the rear end. How often does one see this great responsibility resting on an inexperienced youth, or some weakling of a middle-aged man!

A man fit for the place of flagman should be able to run in fair weather on a railroad track, five miles in sixty minutes. No man should be selected for flagman who has not stood a physical examination and performed a proper running feat, and these tests should be made frequently.

While the old rule requiring the flagman to go back a certain number of yards was not always practicable; yet, I think in changing we have gone too far to the indefinite. Whenever a flagman goes back, he should go back a definite minimum distance, and just before returning, when called in, should place a lighted fusee. There has been too much economy in the use of the fusee.

Another thing that has impressed the writer is that in severe weather flagmen are not equipped with proper shoes or clothing to discharge the duty. No man with thin-soled shoes is fitted to make quick time on a railroad track, particularly at night. A standard, double-soled shoe should be determined on as well as the clothing he should wear in stormy and severe weather. D. F. M.

FLAT SPOTS ON CAR WHEELS.

West Lafayette, Ind., February 11, 1909.

To the Editor of the Railroad Age Gazette:

I have read with interest the various letters on Flat Spots on Car Wheels in the *Railroad Age Gazette* and the *American Engineer*, and have noted the criticisms offered to the mathematical analysis given by myself. (*Railway Age*, Feb. 21, 1908; *American Engineer*, May, 1908.)

It should be clearly understood that when this analysis was written the author made no claim for completeness, but, on the contrary, stated that the factors had been omitted. Two points in the analysis have been criticized, namely, (1) The equating of the kinetic energy of the wheel to the energy of a hammer falling through a given height; (2) The concentration of the mass of the car at the center of the wheel. Regarding the first point I would say that I attempted to measure the kinetic energy of the wheel in terms of some known kinetic energy, and the most natural comparison was with the energy required in accepted impact tests. In using this comparison it is not necessary to consider that the length of the flat spot is sufficient to break the rail. The idea was to equate the kinetic energy of the wheel to the maximum allowed for any given rail and then, taking a proper factor of safety, to get a safe length of flat spot. This method is entirely rational. It is the method used to get the safe tensile strength of materials, for example. In such cases the ultimate strength divided by a proper constant is always taken as the safe working strength.

It is true that in the impact test the rail rests upon supports 3 ft. apart, while in the roadbed these supports are considerably closer, say 18 in. This supposition, then, is on the side of safety. Everything considered, the writer is still of the opinion that no good reason has been advanced to show that the analysis is wrong in this particular.

Regarding the concentration of mass, the writer believes that it is more rational to consider only the mass of the rotating parts as concentrated at the center of the wheel. When this is done the "limiting velocity" is changed from 5 miles per hour to something like 80 miles per hour, as shown by Geo. L. Fowler in the *Railroad Age Gazette*, Jan. 8, 1909. Under this assumption the effect of even small flat spots is very serious. The writer believes that with this change in the original assumption the analysis gives results much nearer the truth than those obtained from any analysis pet proposed.

Another analysis, given by H. H. Vaughan in the *American Engineer*, December, 1908, assumes that there is an upward force equal to $\left(\frac{Mv^2}{r}\right)$ opposing the downward force, as soon as the wheel begins to turn about the forward edge of the flat spot. It is also assumed that the mass of all the parts below the springs may be included in M. This latter assumption is obviously wrong, since only rotating parts can have a lifting effect. Considering the assumption made by Mr. Vaughan, the limiting speed is about 15 m.p.h. While this analysis includes a factor neglected by any other, there seems some doubt as to whether or not the force $\left(\frac{Mv^2}{r}\right)$ acts exactly as assumed.

It has been pointed out that many factors of importance in connection with the effect of impact of flat spots have been neglected among these being the following:

(1) The swaying of the car from side to side, increasing at times the effect of the blow considerably.

(2) The elasticity of the track and roadbed, tending to decrease the effect of the blow.

(3) The bending of the rail, causing it to wrap around the wheel, lessening the blow.

(4) The decreased force of the spring as the wheel is forced downward.

It is obviously impossible to include all these factors in any mathematical analysis with any hope of obtaining results that will be of value. Indeed, it seems to the writer almost useless to extend mathematical work much beyond the present limits until some experimental confirmation of results is obtained. The matter now rests with the experimenter.

E. L. Hancock,
Assistant Professor of Applied Mechanics, Purdue University.

WANTED: RAILWAY STATESMEN.

Indianapolis, Ind., February 19, 1909.

To the Editor of the Railroad Age Gazette:

In an editorial in your issue of January 29, and in a communication from W. J. Harahan in the same issue, the creation of railway diplomatic corps to improve the relations of the railways with the public is proposed and discussed. May I suggest an amendment? It is that the railways should not only have diplomatic corps, but that those who own or responsibly control them should try to install statesmen in the offices of chairmen, presidents and vice-presidents. I do not mean that they should abduct from the halls of congress or the mansions of the governors of the states the very few real statesmen to be found there, and set them to running the roads, but that they should seek for railway directors and executives men who are not only transportation experts, but who are also big enough and broad enough to operate the roads without having constant butting collisions with the public.

A diplomat and a statesman are two entirely different quantities. We have all heard the old definition of a diplomat as "a man who is sent to lie abroad for his country." The railways have had, and still have, a surfeit of diplomats of that sort. A diplomat is one who can argue or bully an angry nation out of giving his country a beating whether it deserves it or not. A statesman is one who so manages the affairs of his country that there never will be just occasion for any other nation to want to beat it, but who is always prepared to thrash any nation that may unjustly try it. A country must depend mainly on statesmanlike, not mainly on diplomatic,

management of its affairs, to insure it external peace and internal prosperity. If it tries to get along without statesmen to guide its diplomats and furnish them with valid, not merely plausible, arguments, it will soon come to grief though it have the best diplomatic corps to "lie abroad" for it that the world ever saw.

The foregoing statements apply to a railway as well as to a nation. The past history and present plight of the railways of the United States strikingly exemplify their truth. The roads always have had diplomatic corps. But the directors, chairmen, presidents and vice-presidents often have not been statesmen. Because many of them have not been statesmen they have done many things that were unstatesmanlike, dishonest or downright outrageous. They have taken advantage of inside information gained through their trusteeships to manipulate the securities of their own roads to rob their own stockholders. They have adjusted rates discriminatingly to build up industries in which they were privately interested. They have paid dividends that were not earned to give otherwise unsalable stocks a fictitious value, and have thereby both deteriorated the service they rendered the public and defrauded the people that bought the stocks. They have been arrogant and browbeating in dealing with shippers that could not defend themselves, while letting big shippers bully and browbeat them.

Understand, I do not charge these things against all prominent railway men, but against only the minority whose lack of statesmanship, of regard for the rights of other railways and railway men, of common honesty and even of common sense, have brought and are still bringing disrepute on all.

To fend off the attacks from the public that their acts prompted and invited, these unstatesmanlike railway managers sent out a diplomatic corps composed of lawyers without practice and incapable of getting any except as pass-distributors, bribe-givers, lobbyists and politicians; of traffic men without any skill in getting traffic except by intimidating little shippers and buying big ones with rebates; and of claim agents incapable of getting at the merits of claims, but very expert at distinguishing between the man who could be bulldozed into not pressing a just claim, and the man who could not be bulldozed into not pressing an unjust claim. Not an admirable diplomatic corps; not one that was well adapted to keep the roads in good odor with the public. But if we condemn the diplomatic corps, what shall we say of the brand of statesmanship that made necessary that kind of a diplomatic corps, or at least created it?

But, railway officers say, the time of the bribe-giving lobbyist and the rebating traffic manager is past. (It would be too obviously untrue to assert that the time of the claim agent who thinks it is his business *not* to settle claims is past.) Unfortunately, the time of railway men of this class is not past. There are many railway lawyers who formerly lobbied or took a hand in politics for their roads against their wills; these lawyers have welcomed the wave of reform that has made it desirable for them to practice law more and to practise politics less. There are many traffic men who formerly gave rebates much against their wills, and who welcome the change that has made success in the traffic department depend more on ability to get business by lawful and honest means and less on ability to get it by lawless and unscrupulous means. But the effect of early training and years of experience cannot be so soon outgrown by all; and when to training and experience are added a natural aptitude and preference for domineering, subterannean or dishonest methods, a man is not apt to change much after he has reached middle age. Consequently, there are still many men in those departments of the railways that come in contact with the public—a good many of them even at the heads of the departments and giving to them their tone—who are utterly unfit to deal with the public under present conditions. And the worst of it is, they haven't the faintest perception of their unfitness, and never will have until somebody higher up blossoms into a statesman, and reforms or "fires" them. If they are traffic men, they keep on swelling up with pride and arrogance like a poisoned pup when some humble representative of the shipping public comes to beseech them at the throne of grace for a trifling concession. If they are claim agents they keep on trying to convince the humble seeker for redress that he is a thief, and a blackmailer, and that it is doubtful if he ever shipped any goods in his life, but pretty certain that he ought to be in jail. The railways of one section of the country persist in keeping as chairman of a large freight association a man whose egotism and arrogance are as insufferable as his talents are negligible; who was never surprised into giving two civil answers in succession to anybody but some railway officer who could cause him to lose his job, but who painstakingly insults everyone else with whom he comes in contact in the course of business; and who, in consequence, is of course daily making enemies for every one of the roads that employ him. Why do the roads keep him without instilling into his narrow and crabbed soul a few lessons in common decency? Heaven knows! And when men who have been exasperated by the arrogant or insulting words or manner of these "old-fashioned" railway men go out and join in agitation for drastic regulation, railway managers are pained and outraged in their very souls, and wonder when the public will cease demanding unreasonable things and imposing unreasonable burdens and restrictions on the railways!

It was not statesmanlike so to manage railways that expert politicians were needed in their law departments, expert bulldozers and rebaters in the traffic departments and expert non-payers of honest claims and skilled payers of dishonest ones in the claim departments. And it is not statesmanlike to keep such men now without compelling them to change their ways. Before the proposed diplomatic corps can be made of real service both to the railway and to the public, railway management must be so reformed that the diplomatic corps will have less to explain and defend that is neither rationally explicable nor honestly defensible. And before railway management will be thus reformed the responsible managers will have to learn that the roads must be operated out on the prairies and in the mountains of the United States and not in Wall street; that the only sentiment that amounts to anything in the long run in this country is public sentiment, not Wall street sentiment; and that public sentiment has got to be both honestly and painstakingly educated, humbly bowed to and even catered to, if the country is to be rescued from the dire menace of general confiscation of corporate property and state socialism.

The honest, hard-working, courteous, able railway officers are a very big majority of the total number. They feel as acutely as anybody the lack of either statesmanship or diplomacy that has characterized the past public relations of most of the railways. They will be more glad than anybody else to see the properties managed with more statesmanship and diplomacy; for the more statesmanlike and diplomatic the management of railways becomes the more true merit and true ability will count for when promotions are made.

A SMALL SHIPPER.

The damage to the Italian railways caused directly by the earthquake was comparatively small; to the rolling stock, almost nothing. But indirectly serious damage resulted. The passenger cars were used for shelters and the cushions removed to make bedding, so that no less than 600 cars must go to the shops to be refitted. The freight cars stranded on the tracks were broken open and anything available for food or bedding generally confiscated. Locomotives were generally abandoned by their crews where the track was deformed, but especially because disabled by lack of water. There will be large bills to pay for loss and damage of freight.

Contributed Papers.

MANUAL BLOCK SIGNALING WITH THE "A B C" SYSTEM ON NORTHERN PACIFIC.

II.

The American superintendent naturally compares this or any new system with: First, the train despatcher system; second, the telegraph block system; third, the automatic block system; fourth, the controlled manual with visual fixed signals (no staff); fifth, the electric train staff.

1. With the time-table and train despatcher system.—It is not necessary to stop to elaborate this comparison, for the train despatcher system has long since condemned itself. To rehabilitate its character it would be necessary to metamorphose the forces of men on every important railway, so that we should have competent and experienced men of high moral character in every despatcher's and operator's chair; and then to take measures to insure that these almost perfect men would be neither overworked nor underpaid. Even with this impossible thing attained, we still have trainmen's errors, forgetting to see green markers, mistaking headlight numbers, reading registers and schedules incorrectly, and other mistakes which do not occur in block working and against which neither conscientiousness nor good drilling can be a complete safeguard. The simple telegraph block system, with the same amount of intelligent supervision given to it, undoubtedly would be safer than the time interval and despatching system.

2. With the telegraph block system.—The telegraph block system as now generally worked, is a safeguard against butting collisions to some extent; but to so small an extent that every where the time-table and its regulations, in conjunction with written telegraphic orders, repeated over the wires at full length, are continued in full force for all irregular movements. Under these conditions the telegraph block system as a time saver is worth very little; and, indeed, nothing at all, unless, by the use of form 19, the stopping of trains for orders is abolished or reduced. The reasons for thus distrusting the system are the possibility of signalmen (operators) forgetting to record a train; failure to read correctly, or omitting to read at all, a record which has been made; and other reasons less definite, or having to do with less serious dangers. Even on double track everyone distrusts the telegraph block system to the extent of retaining the rear flagging rules in full force; and, of course, the possibility of a butting collision on single track is a greater danger than the possibility of rear collisions on any track. On double track, the engineman always has a chance of mitigating the danger to his train by applying brakes; on single track, as against an opposing train, his resources are reduced immeasurably, because the dangerous obstacle is rapidly moving toward him. On double track it may be moving away from him. No one need have any difficulty in getting something better than the simple telegraph block system.

3. With the automatic block system.—Automatic block signals have not been generally favored for single track lines; but with hundreds of miles in use on the Cincinnati, New Orleans & Texas Pacific, for ten years past, and with thousands of miles on the Southern Pacific and the Union Pacific, and with plans now completed for hundreds of miles more on the St. Louis & San Francisco and the Chicago, Rock Island & Pacific, the use of this safeguard on single track is not to be ignored. But as compared with any system operated by men and using simple telegraphic or telephonic communication or electric bells, the automatic system has to answer, not only for the higher cost of installation of apparatus, but for the possibility of failure of apparatus, causing a false clear indication. There is no doubt that the great majority of roads which have considered the automatic system for single track, and have rejected it, have done so largely because of the great cost of installation. This has been allowed to be the controlling argument, and other arguments have not been explored to their final analysis. The question of the reliability of the apparatus must, however, be fully considered, as, thus far, every road using automatics on single track has retained the despatching rules and other safeguards, which fact clearly evidences that the signals are not relied on for complete protection. The protection from the dangers due to broken rails, which is afforded by automatic track circuit signals, is held by some railway officers to be an important element in their favor; but it does not seem likely that anyone is going to make this element the ruling factor in any decision as between manual and automatic block signaling.

Our present comparison, therefore, is one between a manual system, safeguarded by having every vital operation go through the hands of two or three men, and an automatic system in which there are likely to be some delays due to failure of apparatus, and some danger—which, under the most favorable circumstances must be extremely remote—that opposing trains will collide with one another because of false clear signals. The automatic gives notice of broken rails if the break is bad enough to open the circuit or cause a bad escape, while the non-automatic does not. Theoretically the decision must be in favor of the non-automatic, unless experience shall demonstrate that in the operation of it the men cause collisions by mistakes.

But the decision does not hinge simply on a theory. Thus far we have considered only the question of safety. But the question of convenience comes in. Assuming the automatic system to be safe, telegraph or telephone stations are necessary with it for the purpose of advising trains as to their relative superiority at meeting or passing points. With these scattered along the line at suitable distances apart, a manual block system can be worked at small expense. If, however, the ordinary volume of traffic requires trains to follow one another so closely that there must be meeting tracks between telegraph stations, it may well be that the automatic system will prove economical; because with it the block sections may be made short without greatly increasing the expense over what it would be with long blocks.

As a matter of fact, those roads which have introduced automatics on single track seem to have been actuated by varied motives. If passenger trains are few, so that the only disadvantage of having telegraph stations located far apart consists in short delays to freight trains, the cost of automatics may be partly offset by a saving in telegraphers' wages. On lines like some of those of the Southern Pacific, with local freight and passenger stations few and small, this is an element of weight, undoubtedly. In some cases automatics seem to have been favored because of their adaptability to protecting one or two blocks, at a station, even if money be not available to equip all the way through from station to station. Adopting that plan a line can be equipped gradually. This argument has weight with those who have looked carefully at the collision cost and have found a large percentage of it due to small collisions at and near stations.

On the Cincinnati, New Orleans & Texas Pacific automatics were used at first solely as extra safeguards for short sections through tunnels, usually not near stations. The element of convenience, that is, the regulation of trains as regards their relative superiority, was provided for wholly by the old rules, the same as in the preceding case. The automatics were gradually extended to cover the whole road; and this was largely done while the property was in the hands of a receiver. Whether or not scientific railroading thrives better under a bold manager, having to report only to a Federal court and not to a board of directors who are hungry for dividends is a question that cannot be answered off hand; but such an officer usually has freer judgment than the ordinary manager, and that may have been the case here. It may also have been the case that enginemen were more heedless on

this than on the average road, forcing the receiver to adopt any or all means available to prevent collisions. At all events the signals were put in and are now regarded as a vital feature in the successful operation of the road, which for a good part of its length has a heavy freight traffic. Whatever may be the wisdom or unwisdom of an original investment in automatic block signals, no one ever thinks of doing anything but maintain them in the best condition, once they are installed.

The liability that an engineman will run past a stop signal, disregarding it, is an element of danger with any system. With a manual system the monitorship of the signalmen is a strong safeguard against this, and Mr. Beamer provides a further safeguard in his block card; equivalent, in this respect, to a staff. With automatics there is no safeguard except surprise checking.

4. With controlled manual (using visual fixed signals only).—This system in its complete form has not been much used. Theoretically, for preventing butting collisions alone, it is safer than any other system that depends on enginemen seeing and heeding a fixed semaphore (or fixed disk) and remembering, after passing the signal, what its indication was. The cost of installation of apparatus at each station is considerable, and the system has not been used on single track except with continuous track circuits in addition, further increasing the cost. It would be against all precedent to use this system, except under the strictest absolute block signal rules. If it were used with modifications to make it flexible, it would be less safe. Mr. Beamer would have to admit, however, that those features of flexibility which he employs to avoid difficulties at those stations which are not equipped with interlocked switches and distant signals, and not supplied with properly situated passing sidings are elements the possible dangers of which have to be guarded against.

The controlled manual, as used extensively on the single track lines of the Illinois Central, the Burlington and the Chicago & Eastern Illinois, simply compels the two signalmen to act in unison. No track circuits are provided and therefore there is no mechanical lock to prevent clearing a signal to admit a second train to a block which is occupied. The most obvious criticism of this arrangement is that it is incomplete. With it the regular despatching regulations, with written and repeated orders, are maintained.

5. With the electric train staff.—The train staff system is generally agreed to be the simplest and most certain safeguard in use for providing against butting collisions on single track. It effectually compels the station men to follow a rigid routine and in addition makes use of the enginemen to cooperate with the stationmen in following the routine in such a way as to avoid the chance of error; and the engineman knows that neglect on his own part not only risks a danger, but probably promises one. All this is true of the simple old fashioned staff. The electrical apparatus in the electric train staff system, by which staffs are made always equally available at either end of the block section, adds a complication to the plain staff system, but this complication has justified itself. It provides a simple, sure and easily maintained safeguard against errors by signalmen. The electric train staff is superior to the controlled manual, just mentioned, in that without inconvenience it may be locked up, absolutely, from interference by the signalman, whether he be well disposed and careful or mischievous and ignorant. With the regular controlled manual there must be an emergency release to enable the signalman to forward trains in case of failure of the wire or apparatus, and the signalman must have the key to this release. This involves an element of risk unless the signalman is fully competent, level headed and trustworthy. With the electric train staff the emergency release key is the staff itself, and it is in the hands, not of the signalman, who might misuse a release key when a train was in the block section, but in those of the engineman, who cannot use it as a release except when he is at the station; and who, moreover, is the person most interested in guarding against every danger.

Unless elaborate switch and signal arrangements are made at each station it will be as necessary with the staff as without it to provide preliminary written arrangements (orders or cards), or low speed limits at stations, when trains are to meet or are to perform irregular movements. To introduce this highly efficient electrical apparatus and then to partly nullify its advantages by omitting the switch and signal arrangements which are necessary to its convenient and normal operation would be somewhat inconsistent. Other things being equal, however, the staff system, with its absolute locking and its freedom from dependence on telegraphing and pen-writing, is the acme of simplicity; and, assuming the integrity of the electric interlocking apparatus of the instruments, and also for the present leaving out the question of cost, the staff system may be said to embody the highest attainment, in this field, in the direction of protection against butting collisions.

But of course the question of cost is *not* left out. Many managers would decide in favor of Mr. Beamer's plan at once, as compared with either automatic or controlled manual, because of the cost of installation of apparatus and appliances. (As already intimated, the telegraph block system in its ordinary form and the time interval system are assumed to be out of the race.) The Northern Pacific officers, however, are not short-sighted, and they may be assumed to have considered the whole question with care. Mr. Beamer's system is prima facie safe; has it elements of risk which are of enough consequence to warrant them in deciding, in order to abolish such risk, to incur the cost of installation and the cost of maintenance of electric apparatus; the introduction and training of a new class of mechanical men (maintainers of electrical apparatus), and the delay necessary to make the change to the controlled manual or the automatic? (Mr. Beamer's plan can be introduced anywhere with only a brief preparation.) No accurate comparison can be made, of course; for the most expert insurance actuaries have failed to estimate the probable cost of collisions under any method of train management, let alone a method obviously far better than the old-fashioned ordinary methods. Furthermore, comparisons are impracticable because so much depends on the highly variable "personal equation."

But, assuming that automatics are rejected because of high first cost and the time required to get them; the staff because of cost and of the need of well-arranged side tracks and a full equipment of approach signals; the modified control apparatus (like the Burlington's) because, after making the investment there is still a good deal of the "personal equation" left to be dealt with—assuming all these conclusions on the part of the officers of the Northern Pacific, the ground of their decision in favor of Mr. Beamer's plan is clear.

And how nearly does their system approach to perfect safety? The testimony of the Northern Pacific men who are working it and who are thoroughly familiar with the ordinary methods of train management—the methods formerly in use by themselves—is enthusiastic; both as to simplicity and ease of management and as to elimination of chances of error. As, however, a year and a half will be looked upon by most critics as not affording a large body of experience, it will perhaps be fair to suspend judgment, so far as this testimony is concerned. But the tripartite scheme is not new; it has been in use on the Erie, in Ohio, for 17 years, and is still in use throughout that company's main line in Ohio and Indiana. Superintendents, trainmasters and despatchers who have been on those divisions throughout these years, and of several of whom we have inquired, are unanimous in their testimony that *no collision has occurred* because of any fault in the system. (The Mozier system, described in the *Railroad Gazette*,

October 9, 1891, and also in *The Block System*, pages 51-55.) On the Erie time-tables and time-table rights are still in force, and the use of written and repeated orders is continued as of old. This being so, no precise comparison can be made between Mozier's plan and Beamer's. But as to the value and success of the main feature—the three-man interest in each blocking operation—the newer system has all the advantage of this evidence from the operation of the older one. And it must be regarded as very satisfactory evidence.

As supplementing this evidence from men who can testify to the absence of collisions, on a limited length of railroad, it will be of interest to scan the evidence from a wider field—the whole United States. This is a different kind of evidence, but it is not without its value. We mean the evidence concerning collisions, as given in the Government accident records. From these records we may study the specific mistakes which have caused collisions, and each railway officer who is familiar with train management can make his own estimates as to how completely the new safeguards in the Northern Pacific practice will prevent the recurrence of errors of the kinds cited.

Confining ourselves to telegraphers' and despatchers' errors, we may find in the Government bulletins beginning with the last one issued and continuing back to January 1, 1907, the cases enumerated below.

With telegraphers well instructed and well trained and constantly supervised by a despatcher who is determined to secure perfect service, errors by station operators are rare—so rare that to estimate the probable frequency of any particular error, or of errors generally, is out of the question; but this list will aid the reader in calculating what the tripartite system ought to accomplish. In these bulletins, issued quarterly, there are shown, each issue, the most notable cases of collisions caused by negligence or mistakes of any kind. Picking out those due to misconduct or negligence of operators or despatchers we find:

Bulletin 29, collision 8. Inexperienced operator took a message correctly, but then made a new copy, throwing away the first one, and in the new one made a mistake in writing the time. Collision No. 11; operator received an order for a train which was at his station, but which had passed the office and got away before he could deliver the order. Collision No. 9; train passed while operator was asleep and he, on waking, "took chances" and accepted an order for that train.

Bulletin 28, collision No. 3. Inexperienced operator bungled an order given in irregular form by a trainmaster, the despatcher's wire being out of order. Collision No. 8; operator neglected to deliver an order. He had in hand four orders, but delivered only three.

Bulletin 27, collision No. 3. An operator received an order requiring a train to be at a certain station at 12:15, but he wrote "12:50." In this case, as in the one above mentioned in Bulletin 29, it is believed, though not proved, that the operator, not being satisfied with the copy which he had made, rewrote the whole order, and in rewriting made the mistake. This operator had not had proper sleep preceding the time when he came on duty.

Bulletin 27, collision No. 2. Operator failed to deliver order. Collision No. 12; operator omitted the word "East" from the name of the meeting station. Collision No. 13; operator made mistake in writing name of station in meeting order.

Bulletin 26, collision 26. Operator reported that a train had not passed when it had passed. He looked out of his window and saw the headlight of a locomotive and took it for train No. 6, whereas train No. 6 had passed, having (by order of despatcher) left the station ahead of time. Collision 21; operator neglected to deliver one of four orders. He had telegraphed the conductor's signature to the despatcher before the conductor had signed.

Bulletin 25, collision No. 27, was due to careless reading of an order by a conductor and engineman; but the operator was held partly at fault for having made interlineations in the order. Collision No. 30 was due to an error in sending or receiving the number of a train in an order. Collision No. 28 was due principally to the failure of an operator to deliver a meeting order. He accepted it after the train had gone beyond his control. Collision No. 31 was due to errors in the writing of an order, leading to its non-delivery. The number 611 was erroneously copied as 411. In this case one operator succeeded another in the middle of the process of receiving the order. Collision No. 4 was due to an error in a despatcher's order, two words, including the name of the station, being written twice. Collision No. 9 was due to incorrect copying of an order, 1384 being written 1382. Collision No. 14: despatcher completed a meeting order to an inferior train before properly placing the order for the superior train. Collision No. 15 was due to failure to deliver a meeting order. The operator had put a substitute in his place for 30 minutes and had not properly informed the substitute about the order. Collision No. 22; an operator, in service one month, accepted a meeting order after the train had passed, he having been asleep.

Bulletin 24: collision No. 12, was due to an error by a block signal operator, who reported a freight train as having cleared the block section at his station when it was standing partly in the yard. The signalman claimed to have been informed by the yardmaster that the block was clear. Collision No. 16 was due to wrong information given by an operator to the despatcher. The operator had entered a train on his record, but 10 minutes later, answering an inquiry from the despatcher, said that it had not passed. Collision No. 7 was due to the neglect of an operator to deliver an order. He cleared his signal for another train and forgot to restore it to the stop position. Collision No. 8: operator, 17 years old, accepted an order after the train had left.

Bulletin 23: collision No. 30, killing 32 persons, was due to the failure of an operator to deliver an order. A passenger train which he should have held for the order was on the side track, and the operator claimed to have thrown his signal (while he was taking the order) so as to stop the train; but the signal was not put to the stop position, and the train got away from the station without having the order. Collision No. 9 was due to the error of a despatcher in sending an order to the wrong train; mixing the first, second and third sections in certain clauses of the order. Collision No. 17 occurred under the manual block system, the signalman at fault being a former brakeman, and not a telegrapher. He seems to have misread or to have misunderstood a signal given by bell code, either four or five taps. Collision No. 5 was due to an illegible train order. The order was written "3d 73," but was taken to read "2d 73." Collision No. 13 was due to conflicting train orders. A despatcher, new on the division, forgot an order which had been issued by another despatcher about one hour before.

Having in mind the provisions of the Northern Pacific system, the way in which it would have met the test in the emergencies above enumerated is indicated or suggested in the notes below:

Bulletin.	Collision.	Safeguard in A B C System.
29	8	No writing of time required in orders. All orders very brief and far less varied.
29	11	Enginemen must at every station get an order before starting. Always gets one order; never more than one.
29	9	Every train must get an order at every station, asking for it, if not offered.
28	3	No authority to move except on order of despatcher; but if in emergency operators were authorized to act without consulting despatcher, the superior simplicity of the system would be an important element of safety.
28	8	Enginemen must call for orders. Always one order; never more than one.
27	3	Same as 29—8. If an operator sleeps at his post the despatcher's constant intervention exposes the fact.
27	2	Same as 28—8.
27	12	Name of station in order always the same, except in case of an intermediate blind siding.
27	13	Same as 27—12.

Bulletin.	Collision.	Safeguard in A B C System.
26	26	Operator deals with only one train at a time. Number of train or engine usually of minor importance.
26	21	Same as 29—11. No chance for nor temptation to dishonesty in handling signatures.
25	27	As to the operator, orders are far simpler in form. The only danger in reading concerns two features, the number of an engine to be met and the name of the track on which it is to be met; but no order ever specifies more than one meeting station. A mistake in the engine number is not likely to lead the train into danger as it has arrived at the end of the block section before the mistake takes effect, and the clear signal for the next block does not depend on an engine number.
25	30	Only one train being dealt with at a time, its number is not vital.
25	28	Same as 29—11.
25	31	Only one eastbound or one westbound train is dealt with at one time. Orders are so brief that operators would be more likely to finish the writing.
25	4	Error would not occur in writing the simple A B C orders.
25	9	Same as 29—8.
25	14	Operator's duplication of despatcher's work is a safeguard against errors on his part.
25	15	Same as 29—11.
25	22	Same as 29—11. An operator, having delivered an order, at once reports the departure of the train; or if he fails to report, the despatcher who is waiting for the report is likely to call him to account.
24	12	A signalman who accepts somebody's word in a matter like this, would appear to be grossly careless; and a block signal situated so far from the station as to make this error possible is badly located. It is to be hoped that such practice is not tolerated on the Northern Pacific, or on any well-managed road.
24	16	The despatcher's constant knowledge of all trains at all stations greatly aids him in detecting operators' errors.
24	7	Same as 29—11.
24	8	Same as 29—11.
23	30	Same as 29—11.
23	9	Operators check despatcher; despatcher sends forward from each station only one train on each order. Number of train or section relatively unimportant.
23	17	Despatcher's supervision checks operator's errors
23	5	Number of train relatively unimportant.
23	13	Operators check despatcher's acts.

It will be observed that all but two of these errors occurred under the ordinary despatcher system, a system which at the outset was treated as already condemned. The facts, however, constitute a significant body of negative evidence in favor of a simple system like that on the Northern Pacific. Except in the matter of going to sleep on duty and cases of obviously insufficient training, the errors were of a kind which operators of character, intelligence and experience will admit are liable to be committed by a large percentage of operators who ordinarily do satisfactory work. In other words, it is a fair inference that with simpler requirements these same operators would commit errors far more rarely. Their inefficiency is not due in marked degree to moral delinquency or lack of ordinary intelligence. As the manual block system, where introduced on American railways, is entrusted usually to the same men who have worked the wires under the former system, this fact is significant.

Collisions due to misinformation given by operators who have been asleep at their desks must usually be charged to moral weakness—the operator's lack of the courage necessary to tell the truth and admit that he could not give an accurate report of trains. Probably it is no easier on the Northern Pacific than elsewhere to get men who will not come on duty insufficiently rested, or who will not tell lies to the despatcher in a vain effort to evade responsibility; but the A B C system has here two definite advantages; operators must get cards for all trains, by asking for them, before the trains are due; and the despatchers have regular communication with all the operators for all trains, instead of occasionally or irregularly.

Two of the errors were made in the working of the manual block system. The operator who took somebody's word as to the movement of a train near his office must, indeed, have been slipshod in his habits; but the railway manager who arranged his block limits and the location of his block offices so that such an error was possible must also be held guilty of very unintelligent practice. The main protection that the A B C system affords against such faults, more than would be afforded by other systems, is in its regular, simple and methodical procedure and in the greater ease with which the despatchers can watch all operations; but the requirement that every engineman shall get a card at every station is an additional safeguard. The error in signaling by bell-taps is not satisfactorily explained. In view of the rarity of that class of errors on British railways, where bell-taps are almost universal, it looks as though this case must have resulted from gross ignorance or dulness. But even if ignorant or dull, an operator under the A B C system, to cause such a collision, must commit his error at the same time that the despatcher, independently of him, has committed an error which will cause the same false movement.

One of the most significant lists of collisions that has ever been published is that appearing in the Interstate Commerce Commission's report to Congress February 23, 1907 (*Railroad Gazette*, April 5, 1907). In this list it is shown that of 160 costly collisions occurring in the United States in the two years, July 1, 1904 to July 1, 1906, seven-eighths, or 140, occurred under the old methods, and one-eighth, or 20, under the block system; that of these 20, thirteen occurred under the telegraph block system and were all due to errors or neglect of signalmen, and that seven occurred under the automatic system and were all due to errors of enginemen. As this article is already very long we will not quote that list here; but we may say that of the 13 errors of signalmen three were errors concerning yard movements which occur under all systems or else are curable only by the most complete interlocking of switches and signals, with derails; four would in all probability have been prevented, in the A B C system, by the despatcher; one was due to gross moral delinquency; two to inexperience, indicating highly reprehensible looseness of discipline; one was under permissive blocking, and two would undoubtedly have been prevented if all trains had been required to call for cards at all stations. A partisan of the A B C system would claim, no doubt, that that system would afford a strong safeguard against errors due to gross negligence, to moral delinquency and even to most of the other faults here recounted; and not without reason; but we have deemed it proper to mention these points because it is not reasonable to demand that any system shall cure all the infirmities of the signalman's mind.

As a system, Mr. Beamer's scheme inspires hopes of excellent results. A mere "system" has no fair chance unless the men who work it are intelligently selected and well trained and supervised. But if the Northern Pacific people, imitating many examples of the last 10 years, should neglect these vital elements, and depend on a "system" to make up for deficiencies in personnel, they would still have a hopeful scheme. Such a course would be unfair to the system; but this system certainly has been fortified against unfair tests with marked ingenuity.

Reference was made in the first article to the card catching apparatus for fast trains. This is now in successful use. The card is attached to a piece of rope 2½ ft. long, which is held in position on a post fixed 7 ft. from the nearest rail, one in front of each telegraph office. On this post or crane there are two ropes, each holding a card, one for the engineman, the other for the conductor. They are picked up by a catcher attached to the cab of the engine and to the caboose or rear coach. The catchers for the engines are attached to the cabs permanently, while those for the caboose or coach are furnished the train crews and carried in their train box. These are provided with a shank that fits in the marker holders on the corners of the cars. When not in use the catcher drops down by the side of the car. The catchers are held in position by the train and enginemen while picking up the cards. There is no trouble from failure to pick up the card at any rate of speed.

ELECTRIFICATION OF MELBOURNE SUBURBAN LINES.*

BY CHARLES H. MERZ, M.INST.C.E.

XV.

There are many arrangements of automatic signaling on the market, but my experience under operating conditions is confined to the Westinghouse and the Hall systems, both of which give good results, the cost of maintaining being low and the irregularities few. In the case of a London railway equipped with the former, a four months' special record was recently taken and gave only one failure for 570,000 signal movements.

The introduction of electrical working renders possible some signal and safety devices which are not readily adaptable for steam locomotive operation. For example, the necessary supply of electrical energy for any power signaling system is placed at the disposal of the railway department at minimum cost. This renders such a system possible commercially in cases where the cost of providing and running special plant for supplying the electrical energy required for power signaling alone would be prohibitive. In spite of this advantage, however, I do not consider that the installation of a power signaling system on your lines would at present show an actual economy if interest and capital expenditure were taken into consideration.† I also see considerable disadvantage in attempting alterations to the signaling system at a time when in any case the railway staff will already be very fully occupied.

As regards automatic safety devices it may, for example, be arranged so that the signals are interlocked with track levers which, in the event of signals being over-run for any reason, will engage with a lever on the train arranged to open a valve on the air-brake pipe line and so apply the brakes throughout the train while simultaneously causing the overload device on the main power switch on the train to open and interrupt the supply of power to the motor circuit, thus bringing the train to rest quite independently of the motorman. Again, in the case of a train over-running a signal, power can be cut off that section of the line at the discretion of the signalman and the train brought to a standstill.

I would, however, recommend that the whole question of signaling and of the provision of special automatic safety devices be left over at any rate until the first section of the lines is being operated electrically so as to profit by the experience of actual working conditions.

The systems of train despatch do not, in my opinion, require any modification for the time being; they are sufficiently good not to have any retarding effect on the improvement in the train service proposed, and can be conveniently considered in detail and dealt with at some later stage when actual experience with the larger number of trains has directed your attention to any real improvement that might be made, and then one or more of the numerous fully developed systems on the market could be adapted for your purpose. This applies to the central area. In the more remote districts, where the traffic is dealt with by single or two-coach trains, it is possible that some economy might be effected by operating under tramway conditions, *i.e.*, by providing no staff at the stations at all and making the train staff responsible for the collection of fares.

The electrification of the railways and the consequent erection of a large and economical power station, capable of generating electrical energy at the lowest possible cost, enables a supply of power to be obtained for any other requirements of the railways at a very low price, and this use of current for other purposes, such as power and lighting, in connection with the railway system should produce not only a saving in cost compared with the present methods of producing power and light, but also, by improving the load on the power station, a beneficial effect on the cost of producing energy for the railways themselves.

It is convenient to consider the lighting of railway stations and offices under two heads:

1. Stations in the central area, such as Spencer Street, Flinders Street, Princes Bridge, Richmond and North Melbourne.
2. All other stations within the radius covered by this report.

The Flinders Street and Spencer Street railway stations already obtain a large supply for lighting from the Spencer Street lighting station, but the lighting has not been extended because the existing plant is, I understand, already fully loaded.

The 500 kw. frequency converters referred to above will, however, provide a considerable margin over the present load and I suggest that the stations throughout the central area should be lit from the 50-cycle circuits. Allowing for losses in conversion, the electricity will be obtained under 1d. per unit and this would certainly show, light for light, a saving over the present working costs. I do not, however, present any estimate as to the actual cost as this is entirely a question of how much light is provided, and no doubt if a change be made you will consider it desirable to do the lighting on a rather more liberal scale than at present. I should recommend that all the stations in the central area be lighted by enclosed arc lamps or else by groups of metallic filament lamps, lamps of this type suitable for station lighting being now obtainable.

For stations outside the central area, I recommend that the lighting should be done from the conductor rail by means of incandescent lamps arranged in series, the number and arrangement of circuits depending on the size of the station. It will be well to allow for at least two circuits on each platform so that the number of lights on a platform, including offices, should either consist of eight, sixteen or some multiple thereof. This would, in my opinion, provide quite a satisfactory service and be an improvement on the existing lighting.

In the more important stations, where, on account of the number of offices and buildings, it might not be convenient to adopt series incandescent lighting, I recommend the provision of a small motor-generator supplied from the conductor rail, suitable for transforming down to 100 volts and running in parallel with a small emergency battery. The operation of this equipment could be safely left in the hands of one of the station officials, the motor-generator being started up when required just like an ordinary motor. The battery would be of sufficient capacity to maintain the lighting service in the event of failure of the supply to the conductor rail from any cause.

Assuming that the lighting of 126 stations in the suburban area covered by the electric traction scheme were carried out, and the lighting of Spencer Street and Flinders Street extended to cover requirements, the maximum demand (at the stations) is estimated at 574 kw. The minimum number of lamps per station allowed in these estimates is sixteen 100-watt lamps (or group lamps) for outdoor lighting and twenty-five 50-watt lamps for the interior of station buildings.

The average cost of wiring, fitting, etc., may be taken as ranging from £2 10s. to £3 per point for platform and outdoor lighting generally, and £1 per lamp for interior work. These prices are inclusive of all material and labor up to and covering the switchboard, and vary with the facilities available for open wiring.* Arc lighting, with enclosed arcs, for piers and yards, may be taken at £17 per lamp, inclusive.

(To be continued.)

*Abstract from the Report to the Victorian Railway Commissioners on the application of Electric Traction to the Melbourne Suburban Railway System. Published by the courtesy of the commissioners.

†The main gain is in the safety of the system, the working and checking being more precise and the relief of physical strain on the signalmen tending to reduce fatigue and increase the efficiency of the men. The abolition of noise from the cabin is also in favor of better concentration of the operators on the work in their charge.

*It is assumed that the existing standards or pendants, including the lanterns, would, if suitable, be available for wiring and fitting with electric lamps.

HIGH STEAM-PRESSURES IN LOCOMOTIVE SERVICE.

BY W. F. M. GOSS,
Dean of the College of Engineering, University of Illinois.

III.

IV. ENGINE PERFORMANCE.

13. *Mean Effective Pressure.*—A review of the calculated results shows that the possible range of cut-off under a fully-open throttle is reduced by a definite amount with each increment of pressure. For example, under 120 lbs. pressure, it is possible to operate at 30 miles per hour with the reverse lever in the fourteenth notch from the center, while at 240 lbs., the longest cut-off under similar conditions of speed is represented by the fourth notch of the reverse lever. It is of interest to note, also, that within the range of the experiments each change in the position of the reverse lever results in a change in power which is nearly proportional to the extent of the movement of the reverse lever.

14. *The Indicated Horse-power.*—The range in the values of the indicated horse-power for all pressures falls between the limits of 134 and 610 h.p. It appears from the results that with the coal used during the tests the normal power of the locomotive tested, when run at speed, is between 450 and 500 h.p. The development of more than 500 h.p. was always attended by unusual efforts on the part of the fireman. The power of the engine, under a pressure of 240 lbs., was readily developed with the reverse lever in the second and

Speed—Miles per Hour	120	160	180	200	220	240
50	28.12	26.12	24.43	25.74	24.08	24.97
40	27.51	25.82	23.68	24.43	23.68	23.86
30	27.46	25.28	24.61	24.91	23.59	24.43
20	28.40	26.14	25.44	26.01	25.51	24.09
Average	27.87	25.84	24.54	25.27	24.21	24.34

Boiler Pressure

Fig. 11—Least Steam for Each of the Several Speeds at Different Pressures.

fourth notches, while under 120 lbs. pressure, either a high speed or a much longer cut-off must be employed before this condition is reached. All this, of course, grows out of the fact that in experiments involving a wide range of pressure the cylinder volume remained constant. It is significant that the only two tests giving a horse-power in excess of 600 were run at 180 lbs. and 200 lbs., respectively. It will hereafter be shown that the operation of the engine under these pressures was more efficient than under conditions of pressure which were either lower or higher. Remembering that the results disclose the entire range for which it was practicable to operate the engine under a fully-open throttle, it will be accepted as a noteworthy fact that the higher pressures do not serve to increase the output of power.

15. *Steam per Indicated Horse-power per Hour.*—The high efficiency which is implied by results showing the steam consumption per indicated horse-power per hour, and the narrow range which they represent, taken in connection with the comprehensive character of the running conditions involved, are matters of more than ordinary importance. For example, at a pressure of 240 lbs., the engine experimented upon, when working under a fully-open throttle, gave a horse-power hour in return for the consumption of less than 24 lbs. of steam, and under any condition of speed or cut-off for which it was found possible to operate the engine under a wide-open throttle, the consumption never exceeded 26.3 lbs. At lower pressures, involving the possibility of a wider choice in the conditions of operating, the range is somewhat increased. Thus, at 120 lbs. pressure, the minimum value is 27.5 and the maximum 33.8, a range which, while greater than that just referred to, is nevertheless extremely narrow as compared with the range incident to the operation of other classes of engines.

The most efficient point of cut-off for the lowest pressure is that secured when the reverse lever is in the eighth notch, which is equal to 35 per cent. of the stroke. At 200 lbs. pressure, the most efficient cut-off is that represented by the sixth notch, or 27 per cent. of the stroke, and the data do not disclose that a shorter cut-off than this under a fully-open throttle is profitable for the engine experimented upon, even though the pressures be raised to 240 lbs. In all cases the best results are obtained at a speed either of 20 or 40 miles an hour; for all pressures above 160 lbs., the most efficient speed is 40 miles. The law of the change of efficiency with changes in speed has been discussed and the reasons underlying pointed out elsewhere.*

The least steam consumption for each speed under the several different pressures employed is set forth in Fig. 11. The values of the figure are of interest. They do not, however, constitute a satisfactory base upon which to form comparisons.

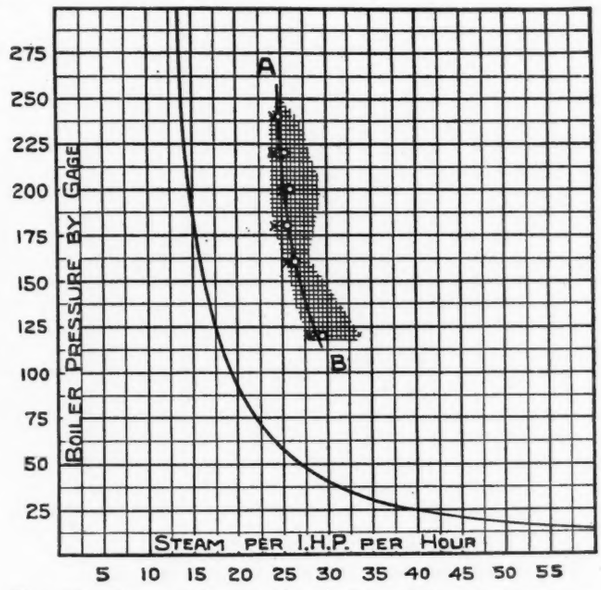


Fig. 12—Steam Consumption under Different Pressures.

16. *Steam Consumption Under Different Pressures.*—The shaded zone upon Fig. 12 represents the range of performance as it appears from all tests run under the several pressures employed. For purposes of comparison, it is desirable to define the effect of pressure on performance by a line, and to this end an attempt has been made to reduce the zone of performance to a representative line. In preparing to draw such a line, the average performance of all tests at each of the different pressures was obtained and plotted, the results being shown by the circles in Fig. 12. Points thus obtained can be regarded as fairly representing the performance of the engine under the several pressures only so far as the tests run for each different pressure may be assumed to fairly represent the range of speed and cut-off under which the engine would ordinarily operate. The best result for each different pressure, as obtained by averaging the best results for each speed at constant pressure, is given upon the diagram in the form of a light cross. These points may be regarded as furnishing a satisfactory basis of comparison in so far as it may be assumed that when the speed has been determined, an engine in service will always operate under conditions of highest efficiency. Again, the left-hand edge

*Locomotive Performance, published by John Wiley & Sons.

of the shaded zone representes a comparison based on maximum performance at whatever speed or cut-off. In addition to the points already described, there is located upon the diagram (Fig. 12) a curve showing the performance of a perfect engine* with which the plotted points derived from the data of tests may be compared. Guided by this curve representing the performance of a perfect engine, a line, *AB*, has been drawn proportional thereto, and so placed as to fairly represent the circular points derived from the experiments. It is proposed to accept this line as representing the steam consumption of the experimental engine under the several pressures employed. It is to be noted that it is not the minimum performance nor the maximum, but it is a close approach to that performance which is suggested by an average of all results derived from all tests which were run. Since its form is based upon a curve of perfect performance, it has a logical basis, and since it does no violence to the experimental data, its use seems justifiable.

17. *Performance Under Different Pressures, a Logical Basis for Comparison.*—The record of boiler performance as set forth in Chapter III., is that actually obtained from the several tests run. It has already been shown that this performance is affected by variations in the evaporative efficiency of the boiler, due doubtless to irregularities in firing, but which are in fact unaccounted for. One of the purposes of the discussion which occupies the preceding chapter has been to reduce the values actually resulting from the tests to a summarized statement which may be accepted as a general definition of performance, assuming all irregularities to have been eliminated. Such a summarized statement is that which is shown by Fig. 9. It is also expressed by the equation

$$E = 11.305 - 0.221\ H.$$

It is now proposed to determine the coal consumption per indicated horse-power, assuming the boiler efficiency to have been in all cases that which is expressed by this equation.

It appears, also, from the data that the steam consumed by the cylinders varies for each different pressure with changes in speed and cut-off, and it has been sought in the preceding paragraphs to summarize the facts derived from the experiments into a single expression. This appears in the form of the curve *AB*, Fig. 12, which is to be accepted as representing the performance of the cylinders under different pressures without reference to speed or cut-off. Combining this general statement expressing cylinder performance with that already obtained covering boiler performance, it should be possible to secure an accurate measure of the coal consumption per indicated horse-power hour, for each different pressure which will represent the results of all tests at that pressure.

The steps in this process are set forth by Table 2, in which—

Column 1 gives the several pressures embraced by the experiments.

Column 2 gives the steam consumption per indicated horse-power hour for each of these several pressures as taken from the curve *AB*, Fig. 12.

Column 3 gives the number of thermal units in each pound of steam at the several pressures assuming the feed-water in all cases to have had a temperature of 60 deg. F. The values of this column show at a glance the rate of change in the amount of heat required to supply steam at the different pressures embraced by the experiments.

Column 4 gives the pounds of water from and at 212 deg. F. per indicated horse-power hour. It equals Column 2 × Column 3 ÷ 965.8.

Column 5 gives the pounds of water evaporated from and at 212 deg. F. per pound of coal and is calculated as follows: Assuming that a fair average load for the locomotive tests is 440 h.p., and that this unit of power is delivered under all pressures, the corresponding rate of evaporation may be found by multiplying this value by those of Column 4 and dividing by the area of heating surface; that is, the rate of evaporation = 440 × Column 4 ÷ 1322. The equivalent pounds of water per pound of coal is found by substituting the rates of evaporation found for H in the equation,

$$E = 11.305 - 0.221\ H.$$

Table 2.—*Engine Performance Under Different Pressures.*

Boiler Pressure	Steam per Indicated Horse-power per Hour. Values from Curve	B.t.u. Given to 1 Pound Steam Feed-water Temp.=60. °	Equivalent Pounds of Water per Indicated Horse-power Hour	Equivalent Pounds of Water per Pound of Dry Coal	Pounds of Coal per Indicated Horse-power Hour	Coal Saving for Each Increment	
						Lb.	Per cent
1	2	3	4	5	6	7	8
240	24.7	1176.6	30.09	9.10	3.31	.06	1.8
220	25.1	1174.4	30.52	9.06	3.37	.06	1.8
200	25.5	1172.0	30.94	9.03	3.43	.07	2 0
180	26.0	1169.5	31.48	8.99	3.50	.09	2.5
160	26.6	1166.8	32.14	8.94	3.59	18	4.8
140	27.7	1163.8	33.38	8.85	3.77	.23	5 8
120	29 1	1160.5	34 97	8.73	4 00	..	...

Column 6 gives the pounds of coal per indicated horse-power per hour and equals Column 4 ÷ Column 5.

Column 7 gives the pounds of coal saved per horse-power hour for each 20-lbs. increment in steam pressure.

Column 8 gives the percentage saving in coal for each 20-lbs. increment in steam pressure.

The values of Table 2, especially those of Columns 2 and 6, are of more than ordinary significance. They represent logical conclusions based upon the results of all tests. Comparisons between them will show the extent to which the performance of a locomotive will be modified by changes in the steam pressure under which it is operated. They show in the matter of steam consumption (Column 2) that—

Increasing pressure from 160 to 180 lbs. reduces the steam consumption 0.6 lbs., or 2.3 per cent.

Increasing pressure from 180 to 200 lbs. reduces the steam consumption 0.5 lbs., or 1.9 per cent.

Increasing pressure from 200 to 220 lbs. reduces the steam consumption 0.4 lbs., or 1.6 per cent.

Increasing pressure from 220 to 240 lbs. reduces the steam consumption 0.4 lbs., or 1.6 per cent.

In the matter of coal consumption (Column 6) they show that

Increasing pressure from 160 to 180 lbs. reduces the coal consumption 0.9 lbs., or 2.5 per cent.

Increasing pressure from 180 to 200 lbs. reduces the coal consumption 0.7 lbs., or 2.0 per cent.

Increasing pressure from 200 to 220 lbs. reduces the coal consumption 0.6 lbs., or 1.8 per cent.

Increasing pressure from 220 to 240 lbs. reduces the coal consumption 0.6 lbs., or 1.8 per cent.

These values are from actual tests. Those who are inclined to insist upon basing their conclusions upon observed data will perhaps find in them a satisfactory conclusion of the whole investigation. The results show how slight is the gain to be derived from any increment of pressure when the basis of the increments is above 160 lbs. But they do not in fact tell the whole story. In order to secure such results from a single locomotive it was necessary to employ a machine designed for the highest pressure experimented upon. Obviously, for the tests at lower pressure, the locomotive was needlessly heavy for its dimensions. If, for the tests under each of the lower pressures, the excess weight could have been utilized in providing a boiler of greater heating surface, the difference in performance with each increment of pressure would have been less than that to which attention has already been called. It is for this reason that the results already quoted, while significant and concise in their meaning, are nevertheless to be accepted as insufficient when regarded as a relative measure of the value of different steam

*This curve represents the performance of an engine working on Carnot's cycle, the initial temperature being that of steam at the several pressures stated, and the final temperature being that of steam at 1.3 lbs. above atmospheric pressure. This latter value is the assumed pressure of exhaust in locomotive service.

pressures. An extension of the discussion leading to a more general view of the matter will be found set forth in Chapters VI. to VIII.

V. MACHINE FRICTION AND PERFORMANCE AT DRAW-BAR.

18. *The Cylinders vs. the Draw-bar as a Base from Which to Estimate Performance.*—In the latter paragraphs of the preceding chapter results are given disclosing the performance of boiler and engine as based upon cylinder performance. This is a correct basis from which to proceed in discussing the relative advantage of different steam pressures; for the process of the cylinders represents the last of the thermodynamic changes by which the heat of the fuel is transformed into work. The cylinders are in fact one step nearer the problem in question than the draw-bar, which for many purposes is properly regarded as a better basis from which to determine the performance of a locomotive. This being the case, the purpose of the present chapter will be entirely served if attention is called to a few of the more significant facts which center in the output of power at the draw-bar, leaving the general discussion as to the relative values of different steam pressures to be continued in the chapters which follow.

19. *Machine Friction.*—This is the difference between work done in the engine cylinders and that which appears at the draw-bar. It is difficult to summarize the facts concerning engine friction. This is not due to defects in the experimental process underlying the data, but to the fact that the frictional resistance of the machinery of the locomotive varies greatly from day to day.* Evidence of this is accessible even to the casual observer. During any given test it is likely that an axle-box or a crank-pin may run warm, while during another test under identical conditions of power the same part will remain perfectly cool. For this reason many variations in the frictional resistance of the machine occur. It is a fact, however, that the friction varies but slightly with increase in steam pressure, and that changes in cut-off are most effective in modifying engine friction. Acting upon this suggestion, all results have been plotted in terms of cut-off. The results do not, of course, fall in line, but they take such positions as readily to suggest the form of a curve which in an approximate way may be employed to represent them. From such a curve the values set forth in Fig. 13 have been derived. It is proposed to accept these values as an approximate measure of the frictional loss for locomotive Schenectady No. 2 under all pressures. They are probably a little low for pressures above 200 lbs. and are perhaps somewhat high for pressures below this limit. It cannot be assumed that they apply to any other locomotive than that which was involved by the experiments. The machine friction as expressed in pounds pull at the draw-bar may be found for any test by multiplying the mean effective pressure for that test by the constant 88.75.

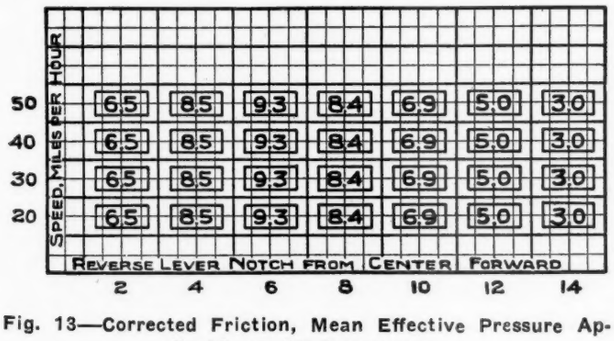


Fig. 13—Corrected Friction, Mean Effective Pressure Applicable to All Pressures.

20. *Steam per Dynamometer Horse-power per Hour.*—Values covering this factor express the combined efficiency of the cylinders and machinery of the locomotive. They disclose the fact that there are few conditions of running for which the locomotive requires more than 30 lbs. of steam per dynamometer horse-power hour, and the consumption may fall below 27 lbs. While differences in performance for all pressures above 200 lbs. are not great, the steam consumption is much greater when the pressure is as low as 120 lbs. The data show, also, that for best results the cut-off must be lengthened as the pressure is decreased. The facts as disclosed by the data are as follows:

For 240 lbs. pressure the best cut-off is approximately the second notch, 14 per cent.

For 220 lbs. pressure the best cut-off is approximately the fourth notch, 19 per cent.

*A general discussion of this question with data will be found in *Locomotive Performance*

TABLE 3.—*Comparative Performance of the Locomotive, Assuming Irregularities in the Results of Individual Tests to Have Been Eliminated.*

Number	Designation of Tests: Laboratory Symbol	Equivalent Steam to Engine per Hour, Feed-water at 60° F	Equiv. Evap. per Pound of Dry Coal by Equation $E = 11.305 - \frac{221}{H}$	Dry Coal Fired per Hour Corrected by Equation, pounds	Dry Coal per I. H. P. per Hour, pounds	Equiv. Steam per I. H. P. per Hour, pounds	Machine Friction: M. E. P	Machine Friction: H. P	Machine Friction: Per cent I. H. P.	Dynamometer Horse-power	Draw-bar Pull pounds	Coal per D. H. P. per Hour pounds	Equiv. Steam per D. H. P. per Hour pounds
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	20-2-240	8803	9.835	895	3.24	31.84	6.5	30.8	11.1	245.6	4600	3.64	35.86
2	20-4-240	12008	9.298	1291	3.29	30.59	8.5	40.2	10.2	352.3	6610	3.66	34.08
3	20-6-240	13614	9.029	1508	3.23	29.12	9.3	44.0	9.4	422.8	7930	3.56	32.20
5	30-2-240	11444	9.392	1218	3.28	30.82	6.5	46.1	12.4	325.2	4060	3.74	35.19
6	30-4-240	13888	8.983	1546	3.28	29.51	8.5	60.4	12.8	410.2	5127	3.77	33.85
8	40-2-240	12320	9.245	1333	3.16	29.20	6.5	61.5	14.6	360.3	3379	3.69	34.19
9	40-4-240	16320	8.576	1903	3.36	28.82	8.5	80.5	14.2	485.8	4550	3.91	33.59
11	50-2-240	14066	8.953	1571	3.37	30.21	6.5	76.9	16.5	388.6	2910	4.04	36.19
13	20-2-220	8533	9.878	864	3.38	33.42	6.5	30.8	12.0	224.5	4210	3.84	38.01
14	20-4-220	10681	9.519	1122	3.27	31.15	8.5	40.2	11.7	302.6	5670	3.71	35.29
15	20-6-220	13294	9.082	1463	3.39	30.81	9.3	44.0	10.2	387.4	7260	3.77	34.31
16	20-8-220	16653	8.521	1954	3.66	31.24	8.4	39.8	7.5	493.2	9250	3.96	33.76
17	30-2-220	10286	9.585	1073	3.35	32.11	6.5	46.1	14.4	274.2	3430	3.91	37.51
18	30-4-220	12976	9.136	1420	3.20	29.06	8.5	60.4	13.5	386.1	4820	3.68	33.60
19	30-6-220	15915	8.644	1841	3.29	28.44	9.3	66.0	11.8	493.5	6170	3.73	32.25
21	40-2-220	11471	9.387	1222	3.29	30.87	6.5	61.5	16.5	310.0	2910	3.94	37.00
22	40-4-220	14549	8.873	1638	3.21	28.57	8.5	80.5	15.8	428.6	4020	3.82	33.94
24	50-2-220	12017	9.296	1292	3.41	31.72	6.5	76.9	20.3	301.9	2260	4.28	39.80
25	50-4-220	16343	8.573	1906	3.39	29.08	8.5	100.6	17.9	461.7	3460	4.13	35.40
29	20-2-200	7632	10.029	761	3.40	34.14	6.5	30.8	13.8	192.7	3610	3.94	39.61
30	20-4-200	9100	9.784	930	3.23	31.64	8.5	40.2	14.0	247.4	4640	3.75	36.78
31	20-6-200	11774	9.337	1261	3.35	31.33	9.3	44.0	11.7	331.8	6220	3.80	35.48
32	20-8-200	15011	8.795	1707	3.60	31.74	8.4	39.8	8.4	433.1	8120	3.94	34.66
33	30-2-200	8768	9.839	891	3.31	32.60	6.5	46.1	17.1	222.8	2780	4.00	39.35
34	30-4-200	11354	9.406	1207	3.29	30.92	8.5	60.4	16.4	306.7	3830	3.93	37.02
35	30-6-200	14685	8.850	1659	3.39	30.00	9.3	66.0	13.5	423.2	5290	3.92	34.70
37	40-2-200	9934	9.644	1030	3.36	32.40	6.5	61.5	20.0	245.1	3300	4.22	40.53
38	40-4-200	13361	9.071	1473	3.28	29.76	9.5	80.5	17.9	368.4	3450	4.00	36.27
39	40-6-200	17822	8.321	2142	3.54	29.54	9.3	88.0	14.5	517.2	4850	4.14	34.46
41	50-2-200	10206	9.599	1074	3.26	31.02	6.5	76.9	23.4	252.1	1890	4.26	40.48
42	50-4-200	14431	8.892	1623	3.49	31.08	8.5	100.6	1.6	363.6	2730	4.46	39.69
46	20-2-180	6638	10.195	651	3.40	34.57	6.5	30.8	16.0	161.2	3020	4.04	41.18
47	20-4-180	8475	9.888	858	3.25	32.15	8.5	40.2	15.3	223.4	4190	3.84	37.94
48	20-6-180	10226	9.595	1066	3.19	30.61	9.3	44.0	13.2	290.1	5440	3.67	35.25
49	20-8-180	12833	9.157	1401	3.40	31.17	8.4	39.8	9.7	371.9	6970	3.77	34.51
51	30-2-180	7523	10.047	749	3.18	31.91	6.5	46.1	19.5	189.6	2370	3.95	39.68
52	30-4-180	9722	9.680	1004	3.16	30.65	8.5	60.4	19.1	256.7	3210	3.91	37.87
53	30-6-180	11633	9.360	1243	3.16	29.58	9.3	66.0	16.8	327.3	4090	3.80	35.54
54	30-8-180	16156	8.604	1878	3.44	29.57	8.4	59.6	10.9	486.7	6080	3.86	33.20
56	40-2-180	8069	9.956	810	3.12	31.14	6.5	161.5	23.7	197.6	1850	4.10	40.84
57	40-4-180	11177	9.436	1184	3.07	28.94	8.5	80.5	20.8	305.7	2870	3.87	36.56
58	40-6-180	14907	8.813	1691	3.23	28.44	9.3	88.0	16.8	436.1	4090	3.88	34.18
59	40-8-180	18949	8.137	2329	3.82	31.07	8.4	79.5	13.0	530.4	4970	4.39	35.73
61	50-2-180	8578	9.871	869	3.24	32.01	6.5	76.9	28.7	191.1	1430	4.55	44.88
62	50-4-180	12061	9.288	1299	3.16	29.37	8.5	100.6	24.5	310.0	2320	4.19	38.90
63	50-6-180	16567	8.535	1941	3.51	29.94	9.3	110.1	19.9	443.2	2320	4.38	37.40
67	20-4-160	7396	10.068	734	3.34	33.69	8.5	40.2	18.4	179.3	3360	4.09	41.25
68	20-6-160	9379	9.737	963	3.27	31.87	9.3	44.0	14.9	250.4	4690	3.85	37.44
69	20-8-160	11392	9.400	1212	3.51	33.02	8.4	39.8	11.5	305.2	5720	3.97	37.33
71	30-4-160	8785	9.836	893	3.28	32.28	8.5	60.4	22.2	211.7	2640	4.22	41.50
72	30-6-160	11663	9.355	1246	3.25	30.38	9.3	66.0	17.2	317.9	3970	3.92	36.69
73	30-8-160	14347	8.906	1611	3.46	30.85	8.4	59.6	12.8	405.4	5070	3.97	35 39
76	40-4-160	10106	9.615	1051	3.31	31.83	8.5	80.5	25.4	237.0	2220	4.43	42.64
77	40-6-160	13406	9.065	1478	3.43	31.05	9.3	88.0	20.4	343.7	3220	4.30	39.00
78	40-8-160	17246	8.421	2048	3.76	31.70	8.4	79.5	14.6	464.4	4350	4.41	37.14
80	50-4-160	10982	9.469	1160	3.43	32.47	8.5	100.6	29.7	237.7	1773	4.89	46.20
81	50-6-160	14940	8.807	1696	3.56	31.39	9.3	110.1	23.1	365.8	2740	4.64	40.84
85	20-4-120	5215	10.433	500	3.73	38.92	8.5	40.2	30.0	93.8	1760	5.33	55.59
86	20-8-120	8592	9.869	871	3.44	33.99	8.4	39.8	15.7	213.0	3990	4.09	40.34
87	20-12-120	12329	9.244	1333	3.73	34.52	5.0	23.7	6.5	333.2	6250	4.00	37.00
88	30-4-120	6269	10.257	611	3.57	36.69	8.5	60.4	35.4	110.6	1380	5.52	56.68
89	30-8-120	10683	9.519	1122	3.45	32.80	8.4	59.6	18.3	265.9	3320	4.22	40.18
90	30-14-120	18654	8.186	2278	4.43	36.29	3.0	21 3	4.1	492.7	6160	4.62	37.86
91	40-4-120	6649	10.193	652	3.54	36.13	8.5	80.5	43.7	103.5	970	6.30	64.24
92	40-8-120	12796	9.166	1396	3.59	32.89	8.4	79.5	20.4	309.5	2900	4.51	41.34
93	40-12-120	18942	8.138	2328	4.20	34.12	5.0	47.3	8.5	507.5	4760	4.58	37.32
94	50-4-120	7129	10.113	704	4.00	40.51	8.5	100.6	57.2	75.4	560	9.34	94.55
95	50-8-120	14371	8.902	1614	3.77	33.61	8.4	99.4	23.2	328.2	2460	4.91	43.79
96	50-11-120	19317	8.075	2391	4.32	34.90	6.0	71.0	12.8	482.5	3620	4.95	40.04

For 180 lbs. pressure the best cut-off is approximately the eighth notch, 33 per cent.

For 120 lbs. pressure the best cut-off is approximately the twelfth or fourteenth notch, 47 per cent. or 56 per cent.

21. *Coal per Dynamometer Horse-power per Hour.*—This factor represents the combined performance of the boiler, the cylinders and the machinery of a locomotive. It connects the energy developed in the boiler by the combustion of fuel with that which is developed at the draw-bar. In all cases where data are given, the fuel consumed was of the same quality; hence all results are comparable. Under a pressure of 240 lbs. the range is between 3.35 and 5.01, while at a pressure of 160 lbs. the range is between 3.79 and 4.78, results which are of interest from at least two points of view: first, because of the small difference in performances resulting from a relatively large change in pressure; and second, because of the significance of the values quoted when accepted as a measure of the locomotive performance. It is doubtful if any other type of steam engine exhausting into the atmosphere can be depended upon to deliver power from the periphery of its wheel in return for the expenditure of so small an amount of fuel.

22. *Corrected Results.*—The values representing coal and steam consumption which have thus far been referred to as performance at the draw-bar are those actually observed. A close comparison of these sometimes fails to give consistent results because of irregularities in boiler performance or in the frictional resistance of the machinery growing out of causes already discussed.

In Table 3 values are presented from which all such discrepancies have been eliminated. They are those which would have been obtained if the evaporative efficiency for all tests had been that indicated by the equation:

$$E = 11.305 - 0.221\ H$$

and if the machine friction for all cases had been that shown by Fig. 13. Column 13 giving the corrected coal per dynamometer horse-power, and Column 14 the corrected steam per dynamometer horse-power, may be accepted as representing the best information derived from the entire research.

(To be continued.)

ELECTRIFICATION OF THE SOUTHERN PACIFIC SUBURBAN LINES.

The power plant for the electrification of the suburban lines of the Southern Pacific across the bay from San Francisco is under construction. It is situated on Oakland Harbor, formerly called the Estuary, an arm of the bay separating the cities of Oakland and Alameda. The main station will have four turbine units of approximately 30,000 h.p. capacity. The station is designed for oil fuel, with provision for conversion to coal firing later, if desirable. The boiler room and turbine room are parallel. The circulating water tunnels of the station will be fed by gravity from the Estuary.

Four Parsons type turbo-generators will supply three-phase, 25 cycle, alternating current at 13,000 volts, when running at 1,500 revolutions per minute. These units will weigh about 323,000 lbs. each. A part of this power will be transformed and converted into direct current for the propulsion of the trains in the immediate vicinity. The more remote divisions of the same service will be supplied from local sub-stations. The turbines will work with 175 lbs. steam pressure, superheated to about 125 deg. at the throttle.

Worthington surface condensing units are connected directly to each turbine, and are designed to maintain 28 in. of vacuum. The tubes in the condensers are not tinned. The circulating pump is a 10,000-gal., high-speed, centrifugal unit, driven by a steam turbine. Each condenser has 12,000 sq. ft. of cooling surface. If the tubes in these condensers were placed end to end they would extend a distance of 36 miles.

There will be 16 boilers, with a total heating surface of about 105,000 sq. ft.. A short stack provides natural draft. It is large enough to give economical results while burning oil. Should coal be substituted later, provision has been made for the installation of a mechanical draft system to give the necessary increase.

Other equipment includes a 60-ton electric traveling crane in the station. Each turbine has a 125 k.w. 250 volt exciter mounted on an extension of the main shaft. The excitation is further reinforced by a motor-driven exciter and a storage battery. The output of the turbines is carried in lead-covered cables drawn through fiber ducts in the walls of the power station to the automatic main switches and then to one or the other of a double set of bus-bars—the main and feeder buses, which are carried on insulators in separate fireproof cells. The bus structure is in the sub-station basement. Over this is the switch structure, similarly made and equipped throughout with distant electrically-controlled switches. The switchboard is carried in a gallery across the end of the local sub-station.

The local sub-station is a part of the main station. The conversion apparatus and operating gallery are at one end of an extension of the turbine room. The sub-station is to be equipped with 2,000 h.p. converting units, every unit being supplied with power by oil-insulated transformers. The sub-station switchboard is set on the gallery at right angles to, and close by, the power station board, so that a single attendant can conveniently look after both. The outputs of the power station and sub-station are carried through underground conduits to an outlet tower some distance from the main building, and are there distributed to their respective pole lines. For transmitting to very remote points, a transformer house is provided, close to the end of the building, where the high tension circuits can be carried directly to their tower lines. The West Oakland and Berkeley sub-stations are similar in equipment to the local sub-station at the power plant, and are fed by duplicate transmission lines. The cost of the power station and its local sub-station will be about $1,800,000. The cost of each additional sub-station will be about $250,000.

The motive power and equipment are to be distributed in trains consisting of from three to ten cars, each car seating approximately 100 passengers and measuring 73 ft. long over all. There will be 62 motor cars, each having a capacity of 500 h.p. and 58 trail cars. The multiple unit system of control will be used. The cost of equipment complete will be $1,869,000.

Inspection and general repair shops for the running and maintenance repairs of the equipment will be located at Alameda Point. These shops will have a steel frame on concrete foundations, the upper structure having brick veneer walls and a saw-tooth roof. This building will be 460 ft. long and 200 ft. wide. The total cost of the shop completely equipped for handling 200 electric cars will be $350,000.

The trolley wire will be No. 4/0. A part of the installation will have side poles with span wire supports, and a part center poles with bracket supports.

FOREIGN RAILWAY NOTES.

Dr. Zemp, many years at the head of the Swiss department of railways and several times President of the Swiss confederacy, died December 8 last, at the age of 75.

The Italian State railways in the year ending with June, 1908, earned net 2.185 per cent. on the capital invested in them. The government pays 3½ per cent. on most of the bonds it has issued.

On Nov. 15, 1908, the entire Austrian ministry resigned, and with it Dr. von Derschatta, since June 2, 1906, Railway Min-

ister, and as such engaged in the very important acquisition of the most important private railways for the state.

The railway in German Southwest Africa, from Lüderitz Bay eastward 227 miles to Keetmanshoop, was completed to the latter place last June and in July earned gross $11,805, or $52 per mile. It was built largely for military purposes, and military traffic is not charged.

An express train from Hanover to Berlin, 158 miles, ran through without stopping Nov. 26, 1908, for the first time, hauled by a 4-cylinder Atlantic locomotive with a tender, the tank of which holds 1,095 cu. ft. of water, of which 318 remained after making the run. The tender tanks heretofore have held but 742 cu. ft.

RAILWAY BROTHERHOODS AND DISCIPLINE.*

BY E. L. CAIRNCROSS.

It is not so many years ago when railway brotherhoods came into existence in this country. They were created by a necessity, were bred by secret ties, and they grew in strength because they advocated better conditions for their members. These brotherhoods have been invariably fortunate in having had their affairs managed by wise and able leaders, who have conscientiously endeavored to secure for their members every concession possible from the railway managements.

Among the uses to which the organizations have been put in the past might be mentioned the mutual benefit insurance feature; the increased compensation now received; the uplift and improvement of members, morally, physically and socially; the weeding out of drunks, dead beats and those whose conduct was such as to reflect upon the organizations; the endeavors to secure reinstatement of discharged employees; the binding together by fraternal ties of men in the same capacities, and the creation of a brotherly feeling that has made railway employees the most charitable lot of men to their fellows that there is in the world to-day. In fact, the brotherhoods have been so well employed in these commendable ways that they have given but little thought to the all-absorbing subject of safety.

Now, while we may candidly differ from the managements upon the question of remuneration and other matters, upon the all-important question of the safe handling of trains there should not exist any difference. It may seem strange, but it is true, that it is a very rare occurrence to find individual employees discussing an accident with the desire to learn a lesson from the event. They discuss such subjects more to extend their sympathy to those at fault, and the object lesson is then passed over and forgotten. In all my experience in lodge room meetings I have never heard the subject discussed there; and I also note that it is an extremely rare thing to find anything in the numerous brotherhood magazines touching thereon. If self-preservation is the first law of nature, why have we been so indifferent? The premiums we pay for accident insurance show conclusively that we men who handle trains are considered an extra hazardous risk. Let us look this question squarely in the face and realize that our turn may come all too soon to appear before the great General Manager of the Universe to render an account of our stewardship in the handling of the people entrusted to our care. * * * People are saying: "You brotherhood men, what are you doing? What have you done in the past?" * * * I would suggest that brotherhood men request their representatives to take up before the executive meetings of their organizations the desirability of embodying in the procedure of business of the subordinate lodges an allotment of time for a discussion on the question of safety. What we need is not a great soul-stirring revival of interest in the subject, but rather a moral awakening to a fuller sense of how deeply we are all concerned in the safe handling of trains.

The power of the railway brotherhoods when used to interfere with disciplinary measures has a very direct bearing on the question of the safe handling of traffic. This abuse owes its origin to a deep sympathy for a brotherhood man in trouble; also to an inconsistent view as to what constitutes justice between officials and employees, and last, but not least, to the feeling among brotherhood men that it is their duty as such to work for a reversal of the decision given a brother, even though there be but the remotest possibility of securing it.

Now this manner of doing business may appeal to sympathetic members, but it is also apparent that such methods can keep their brotherhoods perpetually embroiled with the management. Such courses lower their standing in the estimation of all fair-minded men just in the ratio to which each individual organization is guilty in this respect. Besides, it has a tendency to make employees have greater respect for the powers of their organizations than for a conscientious attention to those duties which the companies have a right to expect from them.

The result is that certain classes of employees are careless in their observance of the rules and regulations. We all know that such a condition exists. And yet brotherhood men, through a mistaken sense of loyalty or fealty to their order, refuse to admit, except to other members, that such things are done. This is a very serious abuse of power. When railway brotherhoods place the bright shining jewel of consistency above them in their lodge rooms to light and guide their work, "Safety" will have one of the strongest links welded in its chain and brotherhoods will receive from officials and the public respect and fair treatment.

TRAIN RULES.

A young man entering the service does so with some knowledge of the dangers to be met, and he has a high respect for the rules and makes conscientious effort to live up to them. If his fellow-workers have the same respect and display obedience, this young man soon acquires a deep-rooted desire to follow their example, but if he is placed in contact with employees who sneer at and find fault with their requirements, and who only obey them when necessary, his viewpoint is changed and he can hardly help dropping into the rut of the easiest way. This being so, to play fast and loose with the rules is to court disaster. Wrecks are not caused by expected occurrences, except possibly derailment on bad tracks. It is the unexpected and unlooked-for that brings disaster, and this to a great extent is the natural sequence of the trivial violation of the rules. It is this lack of attention to the small business details which slowly but surely grows and multiplies, ever widening its scope, breeding grosser carelessness and recklessness, and lessening each day the respect for the rules and their use. It lowers the sense of loyalty or fealty until prudence is no longer a virtue, when carefulness brings but a sneer from the careless ones and recklessness is something to brag about—"loyalty," but another name for a "despicable company man"—while the easiest way is insidiously adopted as the best.

Eternal vigilance is the price that must be paid to insure safety. Not the vigilance of officials only, but that of every employee engaged in the handling of trains. Not the methods of officials who give tacit approval to the violation of trivial requirements when they believe the blocked condition of the lines necessitates unusual chances being taken, but the vigilance of officials whose watchfulness over trivial details shows to employees that they will not countenance the violation of any rule. Not the way some employees have of living up to a rule at one place and violating it at another, but the eternal vigilance of men who realize that the strength of the chain of safety lies in the weakest link. Watch the little, trifling requirements of the rules, and the big ones will take care of themselves.

*Extracts from an article in *Santa Fe Employees' Magazine*. The author is a conductor on the Gulf, Colorado & Santa Fe.

Re-examination.—There are a number of lines that require employees to become conversant with the rules and then pass a written examination. If anyone is laboring under the impression that employees remember all the questions they have answered he is greatly mistaken. Employees remember those that have a direct bearing on the duties which they fill, but a quick change to different duties, or being confronted by an emergency where knowledge of a certain rule would show the proper course to be taken proves they have not got it. It has been forgotten. If you don't believe me try it yourself. Ask yourself some leading question not used in your usual routine of duty and see if you know the rules that cover it. There is no use in beating about the bush on this subject. I know, and you know, that we are not as conversant with the rules as we should be, simply because we don't have to make a study of them after passing the examinations. I believe in, and would offer as a suggestion, the plan that all employees engaged in the operation of trains be required to pass an examination every year. — — — !!! — ? — ?? — ??? — Help!

Phew! Such a fracas! Who threw that brick? Wait a minute—gee! but that was an old-timer.

Now let me explain. I certainly woke you up then, but the proposition is not as bad as it looks, and it need cost no employee his position who has any desire to become conversant with the rules. My scheme is this: Employees entering the service or qualifying for higher positions should be required to pass the present written examinations, and the questions should be so absolutely clear and to the point that any employee may readily understand them. Take and divide these questions into groups of, say, ten each. Set aside a month when business is light and have each interested employee sit down at a table in the trainmaster's office and draw one of the groups of ten questions, making written answers to the same without assistance from books or persons, failure to answer all ten correctly to be punishable by being compelled to answer twenty additional ones, failure to answer the twenty to be punishable by being compelled to answer them all. Five demerit marks for each failure, with a limit of twenty, would have a stimulating effect to be better prepared next time. Ten merit marks should be given to each employee who gives correct answers to each of the ten questions.

Bofore putting such a scheme into effect employees should be given ample notice, so as to have an opportunity of posting themselves.

The idea of having employees draw a book containing ten questions from a pile of, say, fifty such books is to free the plan from even the slightest possibility or appearance of partiality being shown anyone.

The suggestion of requiring answers to only ten questions is to make the scheme as easy as possible on all employees, because it is quite evident that, if an employee does not know what ten questions he may draw, he will necessarily have to study so as to be able to answer any ten of five hundred. Besides, it would be useless for one employee to post another on the ten he has answered, because the latter realizes that there is only one chance in fifty for him to draw the same series.

Another advantage would be that employees could wait for an opportunity to pass the examination without loss of time from their work.

It would be possible also that these questions could be changed each year to meet new conditions or any alterations that had been made in the rules.

Before such examination employees should be given every assistance from officials to make clear to them the meaning of any rule, and when they fail to pass the examination every effort should be made to teach them wherein they made their mistakes.

With a thorough knowledge of the rules implanted in the minds of all employees, there will be bred in them a greater respect for the rules.

REBUILDING THE CAIRO DIVISION OF THE BIG FOUR.

A preliminary account of the rebuilding of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis (Big Four) was published in the *Railroad Gazette*, October 27, 1905. A brief history, the character of the existing line, and the nature of the improvement work to be done, were given, accompanied by detailed drawings and descriptions of the most interesting bridges. This work has been completed and we give below some further account of the methods used in the work, of the terminal facilities, operation of the road, etc.

As mentioned in the previous article, the Cairo division, which is 260 miles long, extends from Cairo, Ill., northwardly along the valley of the Wabash river to a point opposite Vincennes, Ind., thence bearing more directly north and terminating in Danville, Ill. Prior to 1905 this road differed but little in its physical characteristics from the standard adopted at the time of its construction in the early '70's. Some steel rail had been laid, not exceeding 65 lbs. in weight at any point, and mostly not exceeding 60 lbs.; and a scattering of ballast, of a poor quality and very scant, had been applied. A few fair-sized permanent structures had been installed, the remainder of the important openings being wooden trestles. Of the minor openings, many had been replaced with cast-iron pipe. The existing ruling gradient was 1.14 per cent. northbound and 1.11 per cent. southbound; the maximum degree of curvature was 7 deg. 30 min., and in the territory between Harrisburg and Danville—about 200 miles—the total deflection was 1,841 deg. The roadbed, both in excavation and in embankment, was poor, being inadequate for the proper support of a high-class track superstructure and to provide efficiently for drainage.

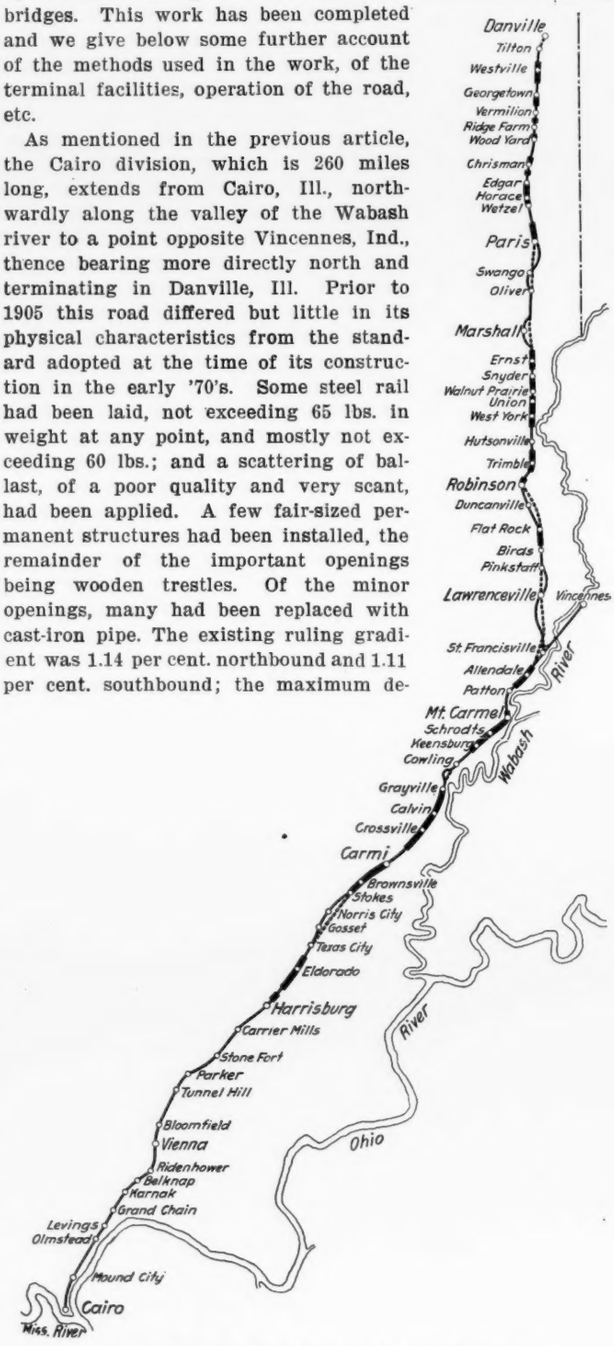


Fig. 1—Revision of Cairo Division; Big Four.

Primarily for the purpose of developing the coal fields in the

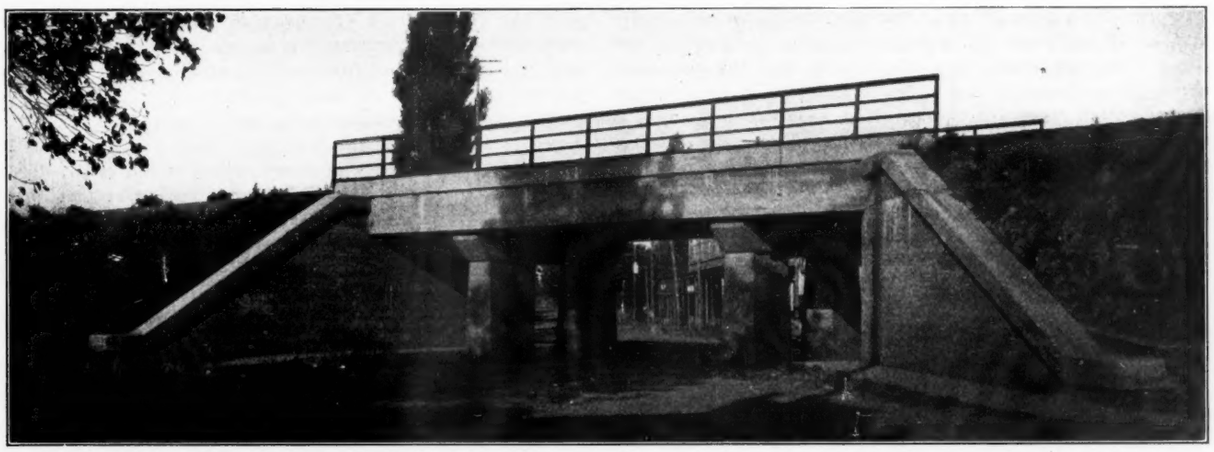


Fig. 2—Reinforced Concrete Subway at Crossville.

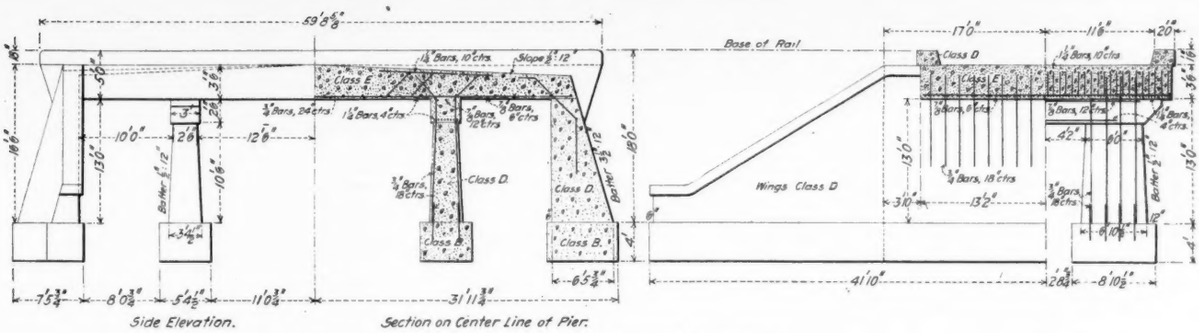


Fig. 3—Details of Crossville Subway.

Fig. 4—Mulberry Street Bridge, Mt. Carmel.

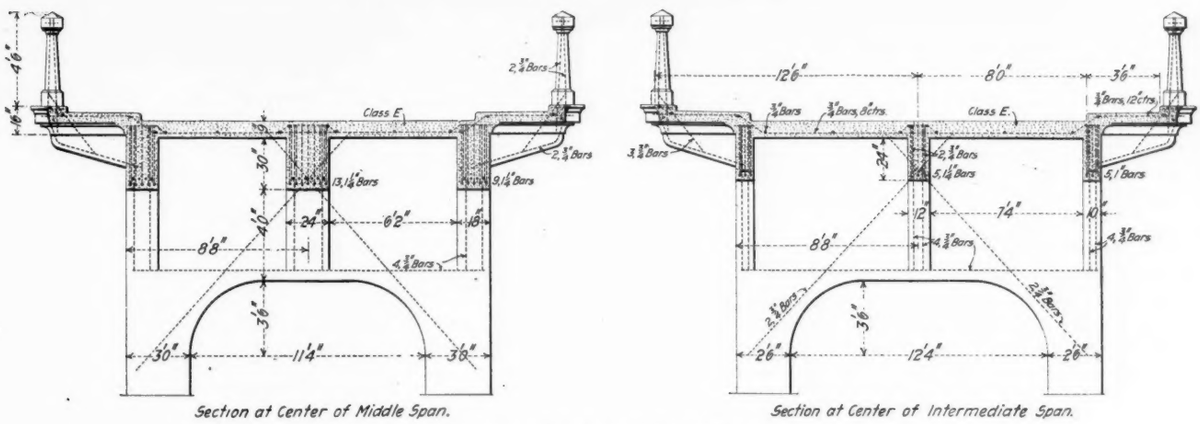


Fig. 5—Cross Sections of Mulberry Street Bridge, Mt. Carmel.

vicinity of Harrisburg, Saline county, Ill., the reconstruction of the line from Harrisburg to Danville, 199 miles, was begun early in 1905. The ruling gradient adopted northbound was 0.3 per cent., and southbound 0.5 per cent., and the maximum degree of curvature 2 deg. The standards of construction were of a high character and involved wide cuttings and fills and permanent bridges of such character as to make possible the operation of the heaviest class of locomotives. The track superstructure consisted of 80-lb. rail throughout, laid in ballast 12 in. deep beneath the tie, and provision was made for ample operating facilities, such as side-tracks, terminal yards, locomotive terminals, shops, water and fuel stations, depot buildings, both freight and passenger, a complete block system, and interlocking plants at all crossings and block stations. Short stretches of the line were also double-tracked where this seemed desirable.

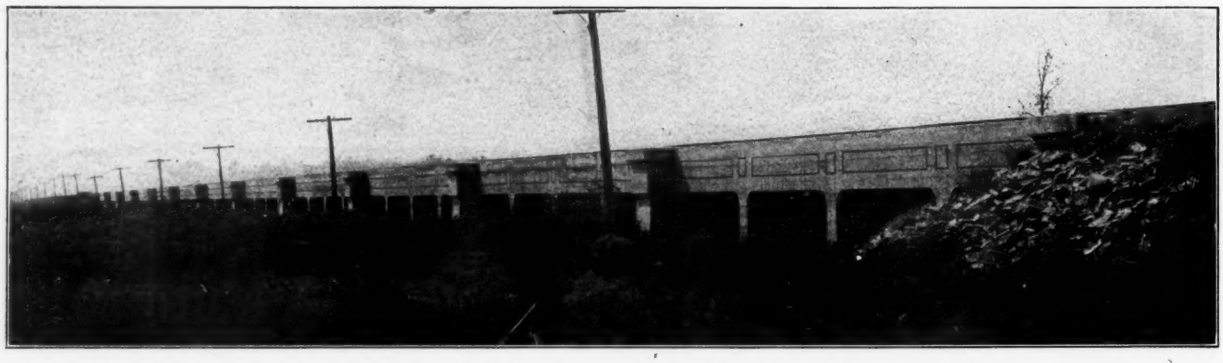


Fig. 6—Reinforced Concrete Trestle in Lawrenceville Bottoms.

Investigation of the problem of reconstruction, as above outlined, developed the fact that in many territories a complete departure from the original location was essential. The aggregate length of such relocations was some 35 miles, the longest single relocation occurring in the vicinity of Norris City, White county, which was 11.5 miles long. The total length of grade reduction, including relocations, was approximately 100 miles, or about half of the distance from Danville to Harrisburg, involving approximately 65 miles of grade reduction where the alinement could not be radically disturbed. In order to avoid the heavy expense and serious disturbance to traffic incident to the reduction of grades upon the actual existing location, the use of offset locations was adopted. These offset locations were sufficiently removed from the original line to permit the maximum cutting to be made below the main track rails and the maximum fill made above them, without general disturbance of the original roadway. The excavations and embankments were not generally brought to a full width before traffic was turned over the new grade, necessitating the widening of both cuts and embankments upon the main track side after the new track had been put into service.

Prior to 1905 the northern terminus of the Cairo division was actually at Tilton, a small town about 3 miles south of Danville, and connection was made with the Wabash for entrance to Danville. In addition to the work above described, an extension of the line was made from Tilton northwardly to a junction with the Peoria & Eastern line of the Fig Four. This extension was double-tracked and involved very heavy work, both in grading and bridges. It passes beneath the Wabash and crosses the valley of the Vermilion river at an elevation of 95 ft. above the bed of the stream.

A good understanding of the scope of the work will be got from the accompanying map, which indicates in dotted lines the relocations and extensions, and in heavy black lines the territory within which grade reduction was undertaken without serious departure from the original location. The entire project involved a total volume of earthwork of something over 5,500,000 yds. and concrete structures to the amount of 65,500 yds. These figures include not only the earth and concrete work involved in the relocation and grade revisions, but also the construction of permanent structures in the territory where grade revision was not undertaken, and the widening of both cuts and fills and the establishment of adequate drainage ditches in the same territory.

The methods used in doing the grading are of interest, more particularly in the method of handling the offset locations. In the majority of these instances the contractor was permitted to use the main track so far as he was able, loading his trains by means of a steam shovel upon the main track; and wherever the embankment was close enough to the original main track to permit, the material was dumped from the old main track and spread by a ballast spreader. For the most part, where embankments were higher than the original main track this lift was made by the contractor raising an independent unloading track instead of by the use of trestles. Trestles were used mostly on the relocations—notably upon the Danville-Tilton extension, where a trestle 85 ft. high and 1,500 ft. long was built over the Vermilion river bottoms of sufficient stiffness to carry standard gage equipment unloaded by a Lidgerwood unloader.

Fig. 7—Riprap Protection.
Showing protection of embankment from washing by floods in ditches.

BRIDGES.

There are a number of interesting designs of bridges, some of which, as already mentioned, were shown in the previous article. One of these was the design for the crossings, respectively, of Vermilion river, near Danville, and of Big Creek, near Marshall, the plans being shown in the previous article, and the methods used in building the Vermilion river bridge being described July 13, 1906. It is formed of concrete arches of the spandrel type, with a central span of 100 ft. flanked by spans of 80 ft. The first-named bridge is 95 ft. from bed of stream to base of rail, and the second 87 ft.

At several points, notably at Crossville, subways had to be

provided over the streets of the town, but the limited head room precluded the use of arches, and box culverts had to be used. One of these is shown in the illustrations. It has a total span length of 46 ft. and is supported at two points so as to give a central span of 25 ft.

Where the cuttings necessitated overhead highway crossings, reinforced concrete bridges of the type which has been generally adopted on the Big Four were put in. The first of these, which are on the St. Louis division, were described in the *Railroad Gazette*, May 18, 1906. The accompanying illustrations show one of these bridges built in the town of Mt. Carmel, which has, in addition to the driveway, sidewalks on each side.

One of the relocations was near Lawrenceville, across the bottoms of the Embarras river. This is a territory which is subject to annual floods, due both to headwaters from the Embarras river and back water from the Wabash river. To insure protection against these floods the railroad was rebuilt at an elevation some 6 ft. above its former grade, and ample passage way for flood waters was provided by two concrete trestles having an aggregate length of 1,562 ft. The detail drawings of these trestles were given in the previous article, and photographs of the finished structure are shown herewith. The fill is protected by riprap from washing by the floods, as shown in one view. As a result of this work interruption to traffic from high waters is a thing of the past.

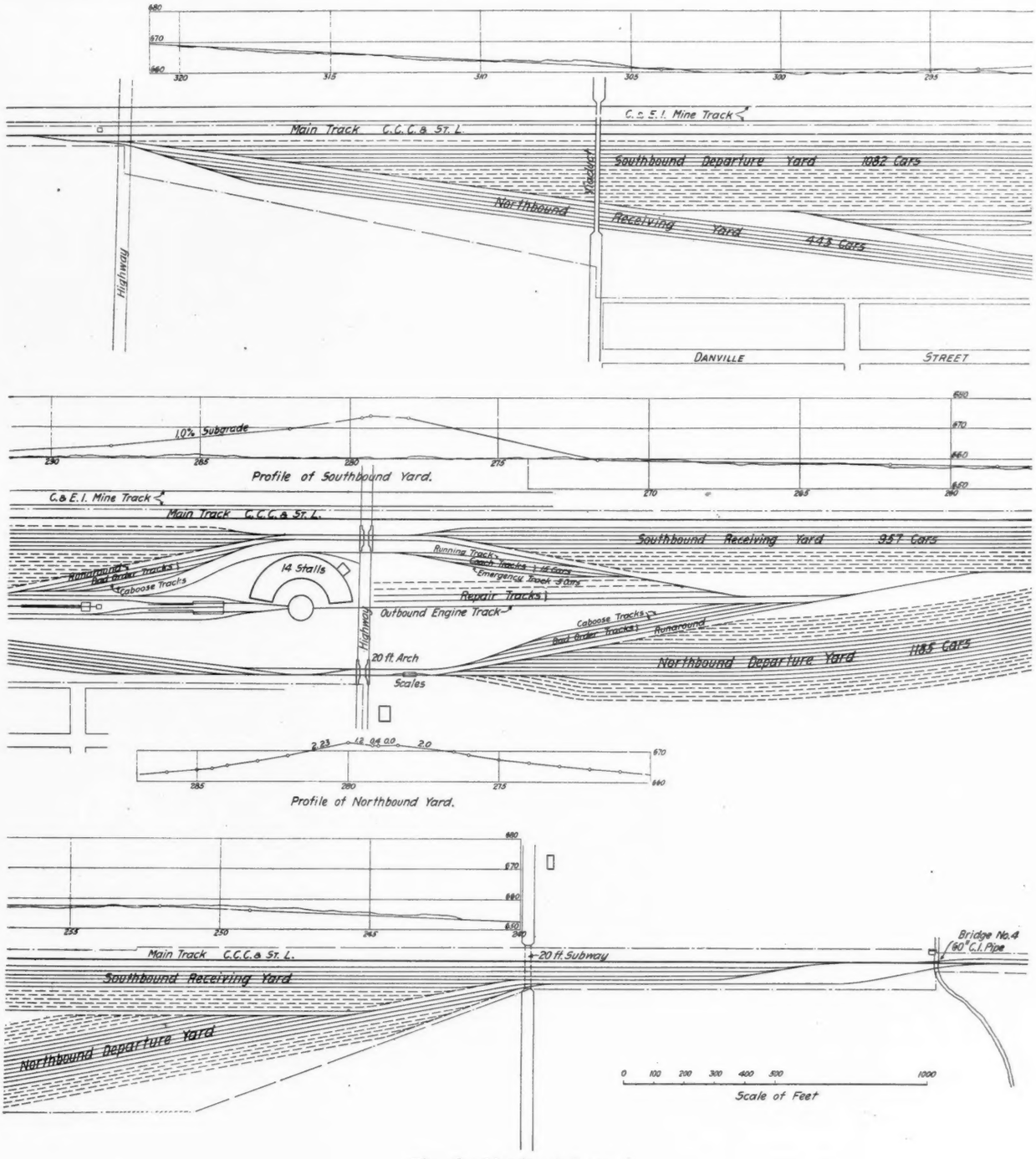


Fig. 8—Yards at Lyons.

YARDS AND TERMINAL FACILITIES.

New yard and terminal facilities had to be provided, and

yards were built at Harrisburg, Mt. Carmel, Paris, and near Danville. All of these except the yard at Paris, which takes care of deliveries to and from the St. Louis division, are hump yards, with inbound and outbound receiving and classification yards, the tracks in each being long enough to accommodate a maximum train. A general plan of Lyons yard, the one near Danville, is shown. Less than half of the tracks have been laid, those for future addition being shown in dotted lines. This being the northern terminus of the division, trains—mostly coal—are made over here for convenience of delivery to connecting lines or consignees at Chicago. The yard is therefore designed to facilitate the through passage of freight from one road to another, the main object being to enable cars to be classified quickly and trains made up therefrom for further movement. The classification consists chiefly of the following:

1. Air and non-air.
2. Chicago loads.
3. Loads for other roads.
4. Dead freight from manifest freight.
5. Bad-order cars from good-order.

Special provision is thus made to take care of bad-order cars, which are separated from the rest and set aside for delivery to the repair tracks.

Close study was given to the matter of proper grades for the humps to give a car or cut of cars the proper acceleration to send them over the scales at a speed of about 4 miles an hour to insure efficient operation of the automatic weighing device; and then by further acceleration to cause the cars to pass by gravity alone to the desired location in the yard. The profile of the northbound hump represents the latest studies of the Big Four engineers in this connection.

What has been said in the foregoing concerning this yard applies to northbound movements only. For the southbound series no scales were provided, as the movements consist largely of empty cars, which need not be weighed. Classification is greatly lessened also, as practically the only division necessary is between good and bad-order cars. Each hump

Fig. 9—Typical Siding and Block Station.

has a high semaphore signal, worked by hand, to give signals to the enginemen.

Locomotive terminal facilities were provided at Harrisburg, Mt. Carmel and Lyons, and at Mt. Carmel new shops of sufficient capacity to take care of the repairs of this division were built. Gravity coaling stations, with 20 per cent. inclines, operated in one case by an electric motor and in two other cases by gasolene engines, were installed at Mt. Carmel, West York and Danville. Additional water stations, comprising tanks of 100,000 gal. capacity and 10-in. cranes, were provided at intervals of approximately 25 miles.

SIDINGS AND BLOCK SYSTEMS.

Ample passing track facilities were established at intervals of not less than 5 miles. Owing to the very low maximum gradient, the actual length of railroad built upon maximum grade was very much increased, and this necessitated almost uniformly the establishment of block stations at summits. A typical view of such a block station, with its accompanying signals and interlocking plant, is included in the illustrations. When the view was made the plant was not yet completed, the semaphore blades being absent, and the old switchstand still in place. It should be noted that provision is made for the entering of a siding by a train at the tower, the switch being thrown by the towerman. The train having entered such a siding, will be on a down grade, and therefore in an advantageous position to proceed from a stop when

Fig. 10—Mt. Carmel Passenger Station.

the block is cleared. Permission to proceed is given by means of a starting signal at the far end of the siding. All railroad crossings with other lines have been interlocked, and wherever it was possible to do so a combination of such interlocking plant with a block station was effected.

FREIGHT AND PASSENGER DEPOTS.

Seven new passenger stations and three new freight depots were built. The largest of the passenger stations is at Mt. Carmel, a view of it being shown.

The work was carried out under the general supervision of W. M. Duane, at that time Superintendent of Construction and later Chief Engineer of the Big Four. F. W. Smith, Construction Engineer, was in immediate charge of the work.

THE SMOKE NUISANCE IN CITIES.*

BY A. W. GIBBS.

Comparisons are continually being made between the railways of this country and those of foreign lands, and these comparisons, while admitting certain great accomplishments performed by our roads, also dwell on our shortcomings, and in no direction more vigorously than as regards the emission of smoke.

Ignoring, for the present, any difference which naturally exists in the fuels used, it should be remembered that on some foreign roads, particularly those of the continent, state ownership is quite general, and such roads have behind them the financial as well as the moral backing of the states; each road is not obligated to the same extent to pay its way, the comparison being somewhat like that of the postal service of our government, for, if the revenue of the postal department is not equal to the expenditures, a deficiency bill remedies the difficulty.

With the railways of this country, the prime essential in

*In response to a request from the American Civic Federation, which has interested itself particularly in the so-called "smoke nuisance" in large cities, A. W. Gibbs, General Superintendent Motive Power of the Pennsylvania Railroad, has prepared the above paper showing the nature of the problem and the difficulties confronting those attempting to deal with it, together with a statement of what has actually been accomplished in the direction of progress.

manufacturing cheap transportation is the possibility of hauling large train units. In this, we differ radically from the railways of other countries, with which comparisons are most frequently made. This means that in this country the locomotive has developed into a power plant of the most concentrated character, for instance: Where with a stationary plant we are satisfied to burn from 15 to 25 lbs. of coal per square foot of grate surface per hour, in many of our locomotives we must be able to burn not less than 100 lbs. of coal per square foot of grate surface within the same period of time. In a stationary plant, fluctuations in the demands are comparatively slight, while with the locomotive, on the other hand, we must be able to vary the output enormously within an extremely short period of time, for instance. A locomotive may be working at full power, producing little smoke, and be suddenly forced to shut off or stop, under which condition the fire will not adapt itself immediately to the changed requirements, and even with care, under such circumstances, the emission of smoke is certain. The reason for this is that while working with forced draft, there is a fair balance between the rate at which the coal is consumed and the air drawn over the fire to complete the combustion, and the volatile material is distilling off at a fairly uniform rate. With the cessation of the draft, but with the coal still emitting quantities of volatile gases, air is not drawn in in sufficient quantity, with the result so frequently experienced. Again, many coals which when burned in a leisurely manner give little or no visible smoke, will give great annoyance when the rate of combustion is doubled or trebled, as the case may be. Consequently, it may reasonably be expected that the terminals in level country, where trains can be handled in and out of the station without excessive demands on the locomotive, are likely to be more nearly smokeless than those where the locomotive must be overworked from the start.

Limitations of space restrict us in the possible dimensions of the locomotive power plant; consequently, the boiler is operated at an intensity nowhere else required. This is the crux of the whole situation, for while it is possible to burn almost any fuel smokelessly, provided the operation be not too hurried, it requires considerable skill and the best appliances to do so when the rate of combustion is forced to the utmost.

The question may now very properly be asked, how do the conditions of the present day differ from those of the past, and why is this question of smoke prevention more important now than ever before?

In answer to this it may be stated: First, that while the locomotive differs but slightly from the older types, there has been a great increase in the number and size of the locomotives and in the demands made on them. Secondly, the complaints against smoke usually come from cities and towns, rather than from the country. This is natural, for the reason that there are more people and more locomotives at the terminal, and it is just there that conditions are naturally the worst, for it is at the terminals where old fires must be cleaned and new ones started. It is then, of all times, that smoke is most unavoidable. It is also true that many railways have built their terminals in what was then the country, but cities have grown up around them, and with the growth comes the complaints.

Again, it must be borne in mind that the railways alone are not the only factors in the problem. In any city where bituminous coal is used for domestic fires and for stationary plants, the increase in the amount of smoke made over previous years is almost directly proportional to the increase in population.

In the case of the domestic fire, little or no progress has been made. While one of these little chimneys may not attract much attention from the smoke which it emits, they are responsible, in the aggregate, for a very great part of the total defilement. It has been proved that the combustion in the domestic fire is apt to be far less complete than in the case of industrial or locomotive fires, for the reason that the consumption is usually very sluggish and a considerable amount of tarry matter exudes and is carried off as soot, whereas in the other fire the temperature is high enough to insure relatively complete combustion.

The means which the railway has at its command for the elimination of smoke, are:

First.—The use of comparatively smokeless fuel;

Second.—The use of devices of various kinds which may allow the use of otherwise smoky fuels; and

Third.—The education of the men operating locomotives and supervising their work.

It is evident that the railways must produce power with the fuel of the country through which they run, and a glance at a geological map of this country, will convince anyone that bituminous coal is that with which this question must be settled. Anthracite is confined to practically a few counties in the eastern part of Pennsylvania. The amount of anthracite mined is a trifle more than 70,000,000 tons each year. It is the ideal fuel for domestic purposes and for use in plants where its cost is not prohibitive. The total amount is so limited, however, that were the demand to be on this fuel alone, the supply would be inadequate, in illustration of which we submit the following statement* of the consumption for the fiscal year ending June 30, 1907, on 20 railways:

These roads consume annually some 39⅞ million tons, 5½ million tons of which is anthracite. Some of the anthracite roads use considerable amounts of bituminous coal. In many cases, this bituminous coal is used as an admixture in order to make it possible to burn under locomotive conditions, the very small sizes of anthracite otherwise not available. This mixture of two coals is not smokeless. Assuming that the entire consumption of these roads were anthracite, it will be seen that this small group alone would consume more than one-half of the total amount of anthracite mined. While such action would doubtless stimulate the production, it would but hasten the disappearance of this most valuable fuel, to say nothing of the enhancement in price which would most assuredly follow. Granting that the anthracite thus absorbed by the railways were replaced by bituminous coal for domestic purposes, the smoke situation would be far worse than at present. The item of cost to the railways would be such a tremendous increase in their expenses as to make it absolutely prohibitive..

The total production of coke is about 36 million tons annually, which is almost entirely used in metallurgical work, for which there is no substitute. While it may be admitted that the production of coke could be largely increased, it should be remembered that in the production of coke from bituminous coal, there is an initial waste of about one-third of the heating value of the fuel, with further losses from breakage in handling, it is evident that this attempted solution would be an unpardonable waste of our natural resources.

However, in the endeavor to obviate smoke, a great many attempts have been made to use coke, and the records of the tests show that the results have been very unsatisfactory, owing to the difficulty with which the fuel is handled, at times the heat being entirely too intense and at others the fire being almost stopped up by the ashes produced. It must not be forgotten that in the process of burning coal to coke, the ash originally in the coal remains in the coke, so that in burning a ton of coke, much more ash results than from the consumption of a ton of the coal from which it was made. The coke, when used, is satisfactory in but one particular, namely, its freedom from smoke.

The reason that anthracite and coke are smokeless is because of the large percentage of fixed carbon and the small percentage of volatile or flame-and-smoke producing material.

Of bituminous coal, somewhat over 400,000,000 tons are mined annually, and the total consumption of this fuel by the

*Omitted.—EDITOR.

railways of this country is estimated to closely approximate 100,000,000 tons. This railway consumption, it will be noticed, is almost sufficient to exhaust the present total production of both anthracite and coke, so that we may as well admit that this being a bituminous coal country, it is this fuel alone that we must consider in solving this smoke problem.

The composition of our various bituminous coals differs widely. Some of them are relatively smokeless. Chemically, these are characterized by the great amount of fixed carbon and the small amount of volatile or flame-and-smoke producing constituents. Approximately, these may range from 70 to 80 per cent. fixed carbon, from 15 to 22 per cent. volatile matter, the remainder being moisture, ash and sulphur. On the other hand, some of the highly bituminous coals will contain less than 50 per cent. fixed carbon, and over 40 per cent. volatile material, and it is with such wide variations in composition that the question must be settled.

It is customary to group under the head of "volatile material," all the substances which will distill from the coal when heated in a closed tube, but on examination it is found that the composition of this material is quite complex, and it does not follow at all that the volatile material of one coal differs only in amount from that of another grade. While much has yet to be learned of the ultimate composition of this material, it is safe to say that some coals contain more of the smoke or soot producing constituents than others. In other words, some bituminous coals while containing approximately the same percentage of volatile material, are more difficult to burn without the emission of smoke.

The low-volatile bituminous coals have, unfortunately, the peculiarity that they are extremely friable and even though mined in lumpy form, will very speedily break up into small size, and although this does not interfere with their usefulness where burned slowly, it is a very serious hindrance to their use in locomotive boilers when worked to the fullest capacity, for the reason that the powerful draft throws out of the chimney a very large part of the fuel put into the firebox, and while at low rates of combustion this is the most efficient of our bituminous coals, this condition does not hold true when the demands on the locomotive are increased. For locomotive purposes, the physical structure of the coal is actually more important than the chemical composition. The important requirements are that the coal shall be fairly lumpy; that it shall be fairly uniform in size; that it shall not readily break up in the atmosphere; and that it shall retain its form in the firebox. When these conditions are met, such fuel can be burned with comparatively little smoke.

A possibility of the future, not yet fully developed, is the use of smokeless or low-volatile coals made into briquettes by the addition of suitable binding material, after which the fuel is pressed into large blocks. The conservation of our natural resources makes it imperative that we should be able to utilize all sizes and kinds of coal, so that instead of selecting the best of the coal and leaving the inferior grades in the mine, the vein which is being mined should have all the fuel removed, as otherwise, the settling of the ground causes the total loss of all the unmined fuel. To the extent that briquetting helps to attain this result, its extension is desirable.

Oil fuel is largely used in some parts of the Southwest, where there are great deposits of oil, otherwise of little value. Owing to the distance and the difficulties of transportation, it is not likely that this fuel can be considered as one available for railways other than those in the territory where such oil abounds, and may be dismissed from our consideration.

To recapitulate: Anthracite, coke and low-volatile bituminous coal are all being used, to a greater or lesser extent, at various points where the smoke condition is most pronounced, in order to minimize the annoyance, but the great question remains: By what appliances or methods, without annoyance to the community, shall we successfully burn the bituminous coal which must be our reliance?

The basis of the requirements for smokeless combustion are as follows:

First—To distill the volatile gases at as uniform a rate as possible.

Second—To present to the burning gases an adequate supply of air to effect complete combustion.

Third—To thoroughly mix this air with the gases.

Fourth—To effect this mixture while the gases are still at a very high temperature.

Fifth—To allow sufficient time for this mixture and combustion of the air and gases to take place before the heat is absorbed and the temperature reduced below the combustion point.

The first condition is the manual one of introducing the coal steadily and in small quantities, preferably allowing it to coke near the door.

The brick arch placed across the lower forward end of the firebox and inclined upward and toward the rear, to act as a baffle to increase the distance that the burning gases must flow before the cooling of the flame is effected. In this process the arch becomes intensely hot, thus maintaining the high temperature while the firedoor is momentarily opened. This device partly meets conditions 4 and 5, and when supplemented by judicious air admission above the fire, partly meets the last four conditions. This, one of the oldest devices, is probably the best and was once the general standard for locomotives. The reason why it was not maintained is that its presence in the firebox is a very serious obstacle to the proper and frequent inspection of the interior, on the perfection of which examination safety hinges. The arch remains incandescent for a long period, thus making proper inspection impracticable. The other reason for its disuse is that the locomotive is a power plant of such concentrated character and so highly forced that the arch alone, without very intelligent firing, will not prevent smoke. To illustrate, it is perfectly practicable to operate at moderate power with such an absence of smoke that for periods of more than one-half hour not a particle of smoke will be visible, but let the conditions change, now shutting off, now working to the utmost limit of capacity, and smoke at once appears because the device will not adapt itself to these extreme conditions.

Other devices embody one or more of the following: Air pipes through the sides of the firebox to admit air to meet conditions 2 and 3; this is only partially effective. Again, air pipes more or less exposed to the heat of the fire so as to preheat the air, are tried, thus attempting to meet conditions 2, 3 and 4. The difficulty with this type is that the heat of the fire usually destroys the device. Still others employ steam jets, sometimes superheated, to thoroughly mix the gases and comply with conditions 2 and 3. Then there is the constantly recurring attempt to bring back to the firebox some of the smokebox gases, as well as the partly burned cinders there collected. This has never been developed to an extent to afford any promise.

In this connection, while considering devices, we cannot omit all reference to the question of automatic stokers. The general progress demands transferring the burden of great manual exertion from the man to a machine. With this end in view, a great deal has been and is being done in the direction of developing automatic stokers which will do the firing with a certain amount of manual supervision. Of these devices, quite a number have been devised and put into use on locomotives. So far, they have not proven satisfactory and, from their imperfections, have not improved the smoke conditions, but the demand for them is so urgently recognized by the railways, not only from the mere smoke question, but also on account of the saving in money and relief to labor, that there is ground for hope that in the comparatively near future a satisfactory automatic stoker will be developed.

The automatic stoker, when perfected, promises to be one of the most effective appliances to aid in smoke suppression.

The gist of the matter is that devices alone, unless supplemented by intelligent and unremitting attention, never long survive. The real reason is, that while new they received a degree of attention that makes them more or less successful, and the credit is ascribed largely to the device when it is actually due to the care.

Evidently, the real line of progress is to stimulate and maintain the intelligent care.

Let us now consider what we believe to be the ultimate solution of the problem, without which the best fuel, and the best appliances, will not be effective in reducing smoke, namely, the education and supervision of the men running and firing locomotives.

It must be remembered that on a large railway system there are thousands of men firing and handling locomotives: First, we have the engineman, who runs the machine and upon whose careful and judicious handling the ease of proper firing largely depends; secondly, we have the fireman, whose skill and interest in properly firing the locomotive must never flag for an instant; third, we have engine preparers and ashpit men at engine houses, who must understand how to clean old fires and build new ones with a minimum amount of smoke.

With the rapid growth of business and consequent increase in the number of employees, it must be realized that supervision in this sense requires a large force of men.

The supervision to be effective involves, first, accurate instruction, and, secondly, repeated personal visitation, and, third, discipline if the instruction is persistently disregarded.

To show how this supervision is being effected, it must be understood that the organization of the railway is practically a military one. On each division, the man in charge of the enginemen and firemen, under the superintendent, is the road foreman of engines, who has assistants, each in charge of districts containing a certain number of locomotives and men. In some cases it is the practice for these assistants to have subordinates to instruct in firing, although the tendency is to put in this position men taken from the ranks of the enginemen, so that their rank will carry authority to instruct both enginemen and firemen. In addition, smoke inspectors, whose entire duty is to report locomotives emitting black smoke, are stationed at various points along the division.

The management has prepared definite and uniform instructions, in printed form, which have been placed in the hands of all men responsible for operating, firing and attending to locomotives on the road and at terminals. From these instructions we quote the following which pertain particularly to the elimination of smoke, namely:

"Enginemen and firemen must work together so as to save coal and reduce smoke."

"The burning of bituminous coal in a locomotive requires air, which must be admitted through the grates and through the fire-door."

"Smoke means waste of coal and must be avoided."

"Large quantities of coal placed in the firebox at one time cool down the fire, cause smoke and waste coal; small quantities at regular intervals will keep the fire bright, prevent smoke and take less coal to keep up steam pressure."

"Lumps of coal should be broken in pieces not larger than 3 in."

"A bright and level fire over the whole grate must be carried wherever possible. When a sloping fire is used, no more coal should be banked at the door than is necessary."

"To prevent smoke and to save coal, the fire-door must be placed on or against the latch after firing or using the scraper, slash-bar or hook, and when on siding, at yards, at terminals, or before starting."

"Before the throttle is closed, the blower must be used and the door placed on the latch. Firemen must stop firing long enough before steam is shut off to prevent smoke and waste of coal."

Under present day conditions, more supervision is required than formerly, on account of the rapid increase in railway business, necessitating the employment and promotion of men who have not been through the long course of probation formerly the rule. At Altoona the locomotive testing plant is being used to educate the Pennsylvania officers interested in the fuel question as to its possibilities, so that they may thoroughly understand how to instruct the men to carry out the definite printed instructions.

Furthermore, this road is recognizing the necessity for greater supervision by the appointment of a greater number of supervising officers so that the number of men under the jurisdiction of each will be small enough to admit of constant personal contact.

It must not be forgotten in this connection, that the cost of the supervision mentioned in the foregoing is a very serious burden on the cost of operation, and while the railways would not provide such supervision but for the belief that it will yield adequate return, or from realization of the duties which the railways owe the public, there must be a limit to the amount of money which they can so expend.

As stated before, the cost of fuel is from 8 to 11 per cent. of the total operating cost of a railway, and, therefore, economy in the consumption of fuel is one of the most obvious ways of reducing operating expenses. Fortunately, the methods described in the foregoing for the elimination of smoke from locomotives, are also those which must be followed in order to obtain the maximum economy in locomotive fuel consumption; in other words, the crew making the least smoke is also apt to save the most coal. It follows, therefore, that the railways have a direct financial interest in the elimination of smoke to the lowest possible limit.

It should be clearly understood that there is no one remedy which can be generally applied. Each situation must be treated as a separate problem, giving attention to such points as the character of the road, as to grades, the loading and speed of the trains, the distance which must be run through thickly populated districts, and whether we are considering a terminal or a through station. For instance, the remedy which has so improved the Washington situation will not apply to Baltimore, because the latter is a through station having adverse tunnel grades on each side. The Chicago situation, with Illinois coal, is still another problem. In brief, an intelligent study of the local conditions must be made in each case.

It will be noted that so far, nothing has been said of the possible solution by electrification.

The cost of everything electric is tremendous. The electric locomotives, such as they are, cost more than double the steam locomotives that they replace, and with this but a small part of the story has been told, as we must add the cost of track preparation, of the power plants, and all that goes to make the electric system as a whole.

While anything of the kind is possible from an unlimited expenditure of money, we do not hesitate to say that the time has not yet come when the enormous outlay of capital for the purpose of the electrification of the railways would be justified by the returns, and, further, we assert that the capital thus diverted would be far more useful in other directions.

POOLING OF FREIGHT CARS IN GERMANY.

The agreement for the co-operation of the State railways of the different states of Germany in use of cars requires that each state contribute a certain number of cars to the pool, dating from April 1, 1909, when the joint use begins. Some of these states have to add comparatively few to their existing stock, but two of them must provide comparatively a large number. Future additions will be made as traffic grows. The total joint stock, April 1, is fixed at 455,256, of which the lines under the direction of the Prussian Minister of Public Works are to contribute 379,669. This minister directs not only the Prussian and Hessian lines, long worked under one management, but those of Alsace-Lorraine, which are the property not of any one state, but of the Empire, and as the sovereign of Prussia is the Emperor, naturally his minister has charge of the imperial railways, whose organization is not otherwise connected with the administration of the Prussian railways. Bavaria is next in order in number of cars, having 42,391.

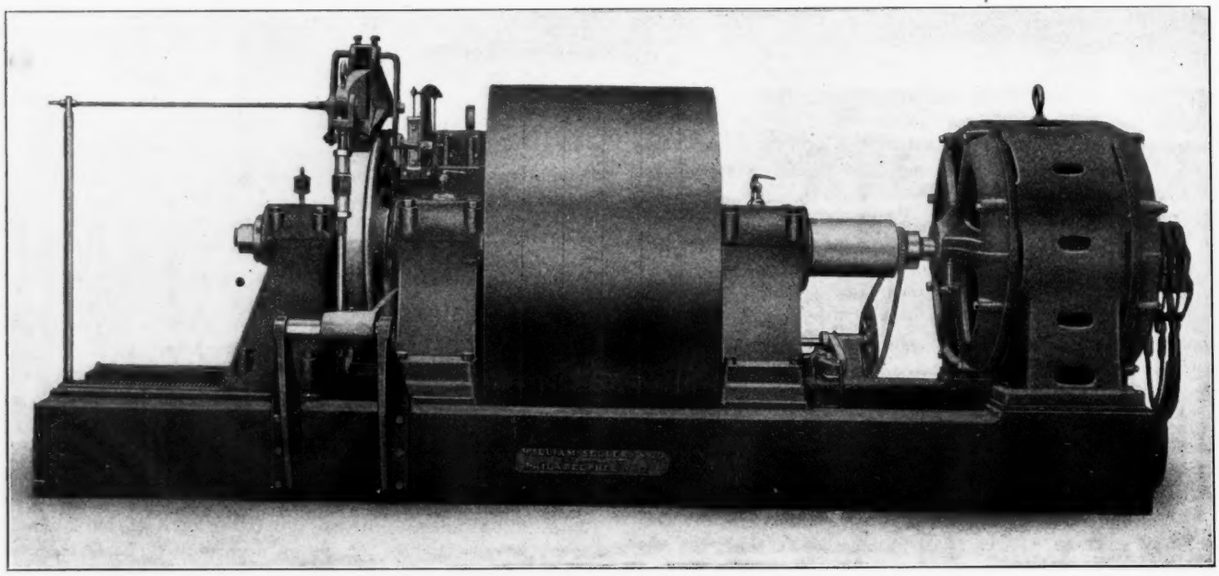
BRAKE SHOE TESTING MACHINE.

The attached illustrations relate to a brake shoe testing machine made by Wm. Sellers & Co. for the American Brake Shoe and Foundry Co., Mahwah, N. J.

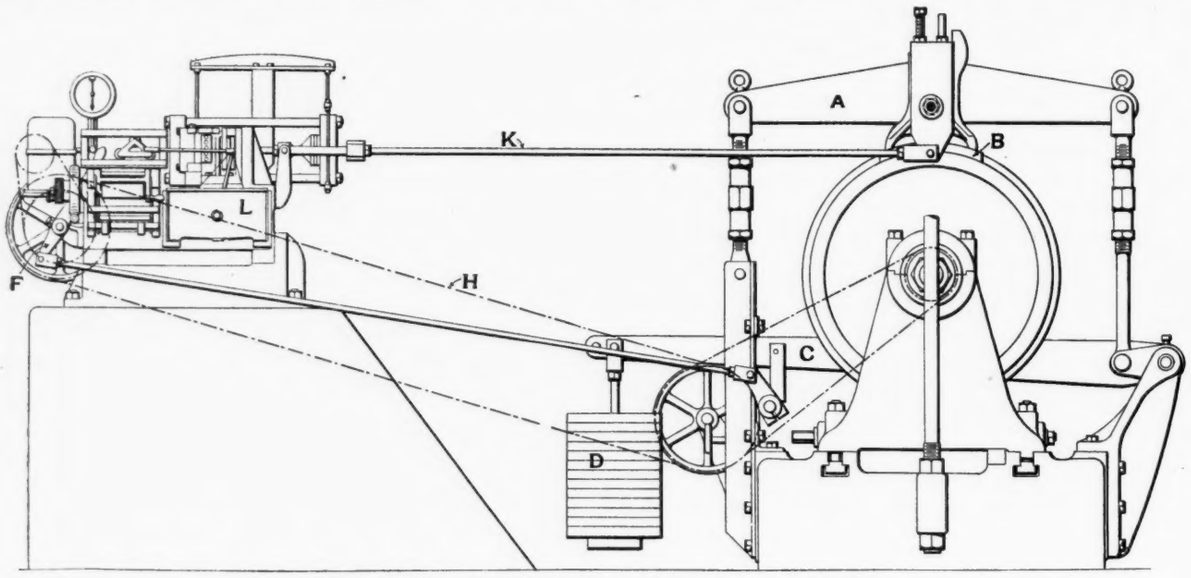
This machine is a development of the Master Car Builders' machine now at Purdue University, and is of more massive and substantial construction and of greater capacity. It is also arranged to be driven by a direct connected motor. By it, brake shoes of various types may be tested under conditions similar to those to which they are subjected in actual service. Broadly stated, its method of action is as follows: A test wheel is mounted on a fly wheel shaft, so that it can be rotated at any desired speed, the inertia of the rotating mass being comparable with the energy imparted to a single freight car wheel by the moving car. The brake shoe to be tested is arranged so that it may be suddenly applied to the wheel under a known load when the driving power is cut off and the tangential pull on the brake shoe, while the wheel is coming to rest, is indicated by a curve drawn by the pencil lever of a special dynamometer on a moving card.

In this machine the flywheel shaft is carried in three bearings mounted on a massive bed plate, which also carries the driving motor coupled directly to the shaft, so that the inertia of the motor may be included in that of the system and the necessary weight of the flywheel proportionately reduced. The test wheel is carried between two bearings, the outer one of which is movable for changing test wheels. This outer bearing was added to relieve the strain on the main bearing due to the higher velocity and greater inertia for which this machine is designed.

The fly wheel is of rather novel construction and admirably adapted to withstand the heavy centrifugal strain. It has the further advantage that its radius of gyration is very large; that is, the weight is concentrated to a great extent in the rim, and thus its total weight could be relatively small. That these are important considerations is apparent when it is realized that the speed and stored energy are equivalent to those of one wheel of an 80-ton car, running at 80 miles per hour. The total weight of the fly wheel itself is 10,800 lbs., and its maximum speed 800 r.p.m. As the fly wheel is 54-in. in diameter, the peripheral speed is 11,350 ft. per minute. It is made in the form of a hollow drum whose heads are steel plates 1⅝ in. thick, and whose circumference is made of rolled



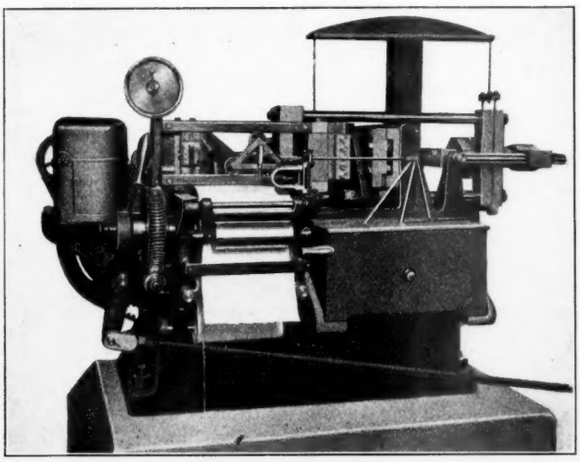
Sellers Brake Shoe Testing Machine.

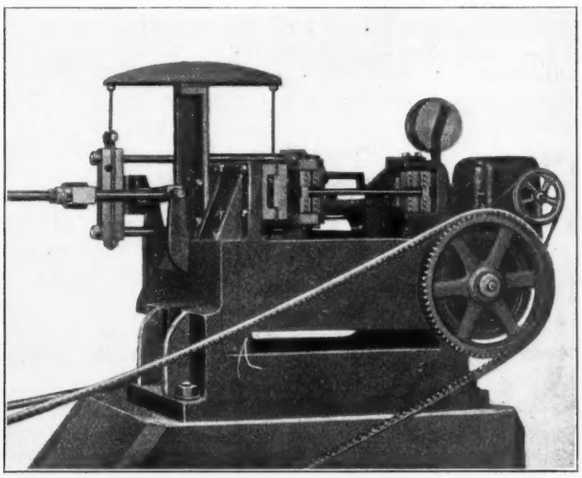


End Elevation of Sellers Brake Shoe Testing Machine.

steel rings tongued to one another and clamped together with heavy rivets.

The drawing shows an end view of the machine in its relation to the dynamometer. The brake shoe B is carried by a device, similar to the brake hanger, from a beam A, in a position directly above the wheel, but not in contact with it. A multiplying lever C is arranged with weights D, which may be varied to produce any required load upon the brake shoe.

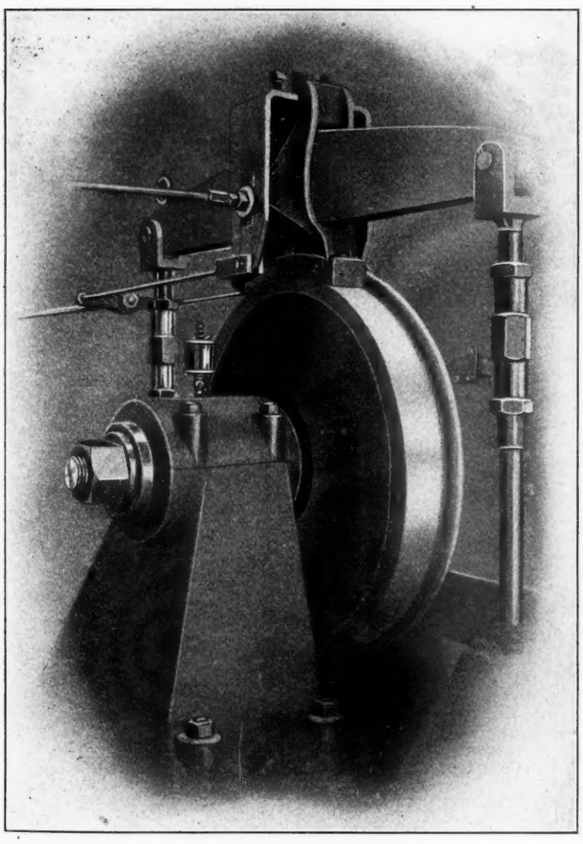




Front and Rear Views of Recording Mechanism; Sellers Brake Shoe Testing Machine.

A tension rod K, is attached to the brake shoe support for transmitting the tangential load to the dynamometer. There is a speed recorder driven by a chain belt H, from the motor shaft, having a dial on which the speed of the test wheel may be read in terms of miles per hour.

The dynamometer is of the Emery design, especially adapted to the requirements of this machine. The tangential load of the brake shoe is received upon a flat spring, the deflection of which is multiplied by levers and transmitted to the pencil carriage. The spring is of such a size as to give, after calibration to known weights, a movement of 4 in. to the pencil for the maximum capacity of the dynamometer, of 4,000 lbs. load on the tension rod. The transverse scale of the diagram, therefore, is 1,000 lbs. per inch. The levers are fulcrumed upon thin steel plates in place of the ordinary bearings and knife edges, thus eliminating friction and greatly increasing the durability.



Test Wheel and Mounting.

When it is desired to make a test the brake shoe is placed in the holder and the motor started, slowly bringing the heavy fly wheel to a speed somewhat above that required. The current is then cut off. The shaft is allowed to slow down until it reaches the desired speed, as observed on the indicator. When this point is reached, the trip lever F is thrown by hand, bringing the brake shoe into contact with the wheel and simultaneously starting a revolution counter. The record, which consists of a blank strip of specially prepared paper, is started in motion immediately prior to applying the brake shoe, the pencil being in contact with the paper at the time. To minimize vibration, a dash pot L is used in connection with the pencil carriage. The pencil draws a curve representing the pull of the brake shoe due to friction between the shoe and the wheel, and a time pen marks seconds on a straight line.

From the diagram and the revolution indicator can be derived the distance traveled after the application of the brake; the average co-efficient of friction and the co-efficient at any time during the test; also the time consumed in stopping, and the number of turns of the wheel. The induction motor drives the machine, which is of the slip ring type regulated by a drum controller, to admit of the slow starting and gradual acceleration necessary when starting the heavy fly wheel.

Since the Sellers machine was installed at Mahwah there has been added a Warner speed indicator from which the speed is obtained accurately within a small fraction of a mile per hour. This instrument is found to be an ideal one for the purpose. There has also been applied a chronograph marking seconds on the paper by which the speed recorder can be accurately checked. An air cylinder connection has been added to raise the weight level, also a tank for cooling the wheel with water if necessary or for applying the brake shoes on a wet wheel. Guards are used to prevent the oil being thrown from the fly wheel. The auxiliary equipment includes a very delicate set of scales, manufactured by H. Kohlbusch & Co., Jersey City, N. J., which will weigh from 50 lbs. to 1 grain, the weights being marked in decimals of a pound. They also

have a very useful machine which faces off a brake shoe or test block to the exact curvature of the test wheel in a few minutes time, doing away with the excessive labor which is often necessary to grind the shoe down to intimate contact with the wheel before making a test.

At present no means are at hand for duplicating exactly the conditions of wearing tests obtained from the M. C. B. machine at Purdue. What is done, however, in this connection, is to run three tests stopping the wheel from a speed of 20 miles an hour with a load of 2,000 lbs., carefully weighing the shoe before and after the test, and comparing the weight with the foot-pounds of work done as indicated on the diagram. This is a more severe test than is made with the M. C. B. machine where the wheel does not actually stop and the shoe certainly gets hotter. In the Mahwah test it has been found that with a test block, having a bearing 12 sq. in. in area the mean co-efficient of friction is practically the same as with a full size shoe having 45 sq. in. bearing area, but that the rate of wear is correspondingly greater with the reduced area in contact up to the point where the heat becomes so high that fusion takes place.

EXPERIMENTAL SIDE DOORS IN THE NEW YORK SUBWAY.

The photograph shows the ends of two cars in an experimental express train which has been running in the New York subway during the past ten days. These cars, originally made by the American Car & Foundry Company at its Berwick shops, were remodeled at the Interborough Rapid Transit Company's shops in New York City. Eight seats were removed and four side doors were cut through, and these side doors, as well as the vestibule doors, are operated by the hand power of the guard, who stands in the vestibule and controls the four doors opposite the platform. The new side doors operate somewhat stiffly; that is to say, the mechanical arrangement is such that it requires either a sturdy or a skilful guard to operate them. The changes made are on the lines shown in the *Railroad Gazette* of February 18, 1908. Bion J. Arnold, consulting engineer, was employed by the New York Public Service Commission, First District, to suggest such improvements in the subway operation as would reduce the congestion and possibly increase the capacity of the line. He recommended some changes in the signaling system, and these side doors, which were to be used for passengers leaving the car, while, at the same time, incoming passengers were using the vestibule doors. The new train did not at first meet with favor from the guards; the operation of the doors required somewhat more than twice as much physical energy at each stop. Frank Hedley, General Manager of the company, has contended that this type of car would be unsuccessful, and expressed himself rather freely at the beginning of the trials; nevertheless, he is giving the train a fair trial. Mr. Arnold has been observing the working of the train and considers it fully up to his predictions. The observed times of unloading and loading at express stations have been about two-thirds of the times required under like circumstances with vestibule door cars only. This would indicate a material increase in the capacity of the express tracks for additional trains during the rush hours.

Side-Door Subway Train; Interborough Rapid Transit.

CAR EFFICIENCY AND CAR SURPLUS.*

BY ARTHUR HALE.

The car surplus has now been in existence for fourteen months† and there is every likelihood that it will continue for eight or nine months longer. When a car shortage does come, as we all hope it will come, it will be a long time before anyone can seriously say that the railways are at fault in not being able to supply all the cars that are needed. This record will stand showing hundreds of millions of useless capital tied up in cars for two years and more.

I am sorry to be obliged to say that we have made little or no progress this year in this common use of cars. To be sure, a few of the railways in the east have made arrangements covering an equal interchange of equipment which involves the common use of cars to some extent. Possibly these arrangements may spread westward, but nothing general in the matter has been done, because with this large surplus, none of us have needed it. I trust that the shippers will not entirely forget the question until the next car shortage comes.

The business of the Committee on Car Efficiency is not confined to the collection of statistics. When there was a car shortage, we were very much interested in the interchange of cars between railways. We kept in close touch with this interchange and whenever we found surplus cars on any one road we did our best to see that the cars were transferred to roads which could use them.

Unhappily, we have had very little opportunity to help in the utilization of surplus cars for a long time. The only material shortages which there have been in the last twelve months have been in the extreme Northwest, when the wheat was moving freely, and these shortages were only indicated because the wheat growers all wanted to ship at once and the northwestern lines could not move the empties to them quite fast enough.

Under these circumstances the committee has had very little to do recently with the movement of empty cars and it has, therefore, turned its attention to the movement of loaded cars.

The question of improving the movement of freight is a question of detail—of infinite detail. I do not mean to take your time by going with any thoroughness into this question, but there is one difficulty which has recently been straightened out, which I feel is of general interest. I refer to the "set-back" rule, which has been in effect at a great many points, especially in the central and western parts of the country, and especially the "set-backs" which have been made on account of defects in safety appliances.

All of us who have had occasion to trace cars have noticed the cases where cars have been delivered by one railway to another, returned the same day or the next day and then redelivered. I have seen a number of cases where this setting back of a car has occurred not only once but twice or three times before the car could pass a junction point and proceed on its journey, and a friend of mine, a car service officer, who has interested himself in the subject, tells me he has seen a case where the same car has been set back five times. I need not tell you that this setting back of cars for repair or for any other reason is a fruitful source of delay, and in considering the general movement of cars, this consideration of the "set-back" was forced on the Committee on Car Efficiency.

Of course, it is primarily a question for the mechanical department and for this reason the transportation men and the transportation committees had not gone into the question very thoroughly, but on taking the matter up with the Committee on Safety Appliances of the American Railway Association and with the committees of the Master Car Builders' Association we found they felt that as their powers were only recommendatory it was not their function to straighten out a matter of this kind.

The Committee on Car Efficiency therefore took the matter up and after a full investigation we presented the facts to the Interstate Commerce Commission. We found that there was a very general impression that the safety appliance law demanded this "set-back." Our investigation, however, showed that this impression was entirely erroneous and that there was nothing in the law to prevent immediate repair of safety appliance defects. Railways are of course at liberty to reject cars with such defects, but the law does not compel this. It would indeed appear that such of the set-backs as involve the hauling of cars with defective safety appliances are absolutely against the law.

Our friends at Washington received us cordially and straightened out the difficulty very promptly. Indeed, their instructions to the Interstate Commerce inspectors were amended so as to remove all possible misunderstanding.

With this basis, the committee is presenting the matter to all the railways at all the junction points in the country, and although it is taking a good deal of time and trouble to cover the ground we are making a great deal of progress in showing the railways that the set-back is not necessary.

I make this announcement to you, gentlemen, because I feel that it is something that is of interest to every one here, and whenever you find a case where a car is set back I trust you will take the matter up and have it straightened out so that this source of delay can be entirely eliminated.

A certain amount of delay is necessary at every inspection point, and this being the case, it is all the more necessary that every unnecessary delay should be done away with in order that the freight of the country move regularly and freely.

*From an address before the Traffic Club of Chicago.

†This paper was written in January.—EDITOR.

STEAM AND TROLLEY IN CONNECTICUT.

The annual report of the board of three Railway Commissioners of Connecticut just at hand represents the product of a "political" rather than a scientific commission. There is, therefore, the usual lack of positive and constructive suggestion and of expressions of policy. The compilations of figures and the records, steam roads and street railways, however, supply the data from which by analysis, can be derived some interesting facts partly obtained by comparison with former reports.

Out of all the steam railways operating within the state the New York, New Haven & Hartford now owns or controls all but two. One of these is the South Manchester line, a private concern operating a total of less than six miles of single track and owned by a manufacturing company. The other is the New London Northern, leased through the Central Vermont by the Grand Trunk, by which the latter reaches the seaboard at New London and carries freight west at differential rates. The line in Connecticut is 56 miles long and, in general character, a kind of "long bridge" with little local traffic and of chief value as an outlet and inlet of the Grand Trunk system. It is interesting to observe that the net income over operation and taxes reported by the lessee is but $72,501, while under the lease it pays the stockholders nine per cent. or $135,000, on the common stock and $71,120 interest on bonded debt denoting the pretty high price that the Grand Trunk pays for its Southern New England outlet. Except some 62 miles the New Haven company thus owns or controls the whole steam mileage in Connecticut. The New Haven system in the four states, Connecticut, Rhode Island, Massachusetts and New York, now contains what were once nearly 100 independent or subsidiary steam lines under separate titles.

The grasp of the same corporation on the Connecticut street railways is impressive. The Commission's report returns a total trolley mileage of 895 in the state. Of this the New Haven company owns directly and has practically merged 486 miles. But in addition it has control of what may be called a sliding scale lease of 215 miles of the Connecticut Railway & Lighting Company, making that 701 miles owned

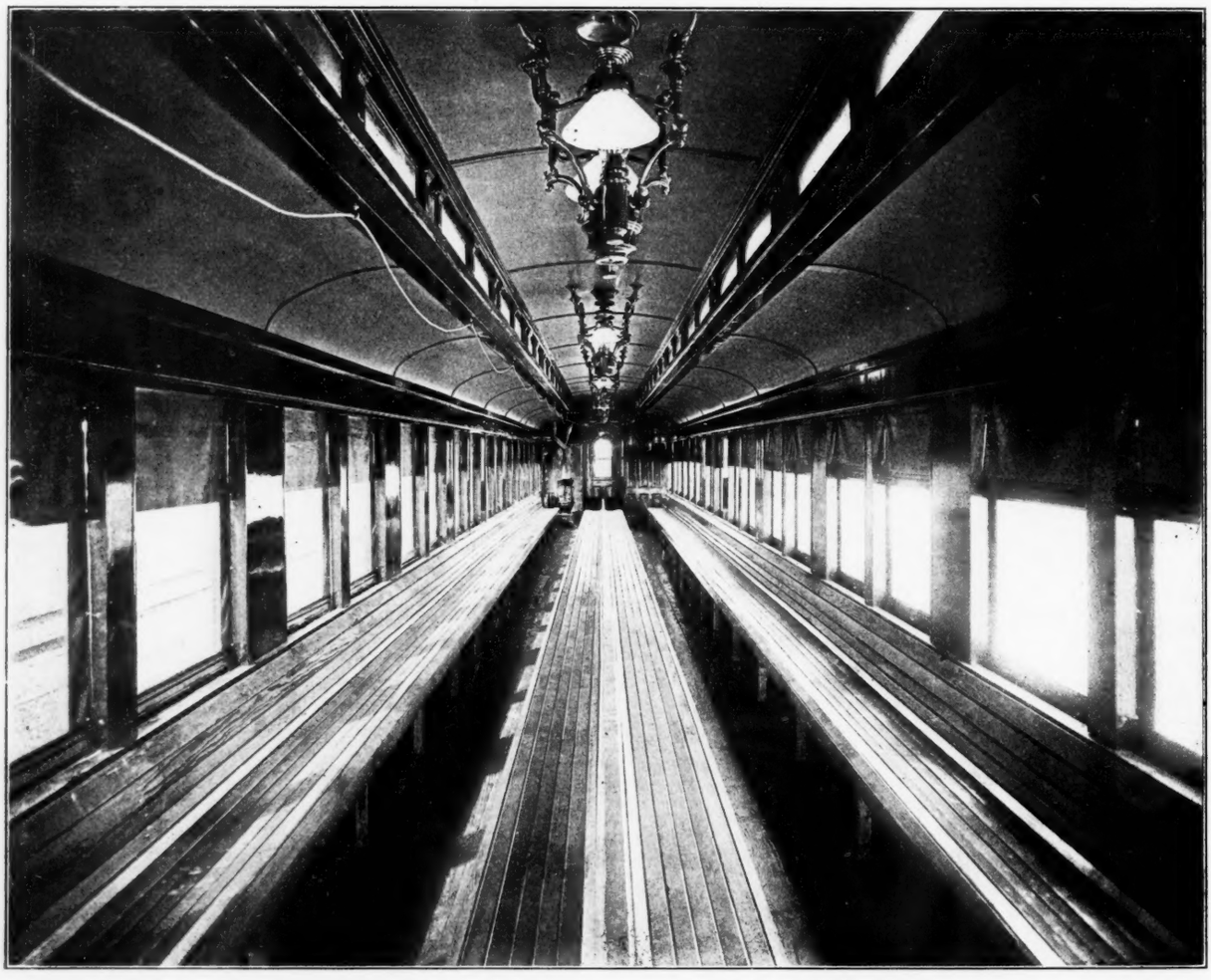
or controlled out of the whole 895 miles in the state or about 79 per cent., which chiefly is vested and operated in the name of the New Haven's "holding" corporation, the Connecticut Company. Out of some 35 street railway companies in the state originally independent only six are so now. The rest have passed under the New Haven's ownership or control.

In the course of the rapid mergers and transfers—during which the New Haven company itself, while retaining its old title, has shifted to the more expansive charter of one of its trolley corporations—the trolley capitalizations in various shapes have been changed into obligations of the steam company and become inseparable. As a consequence Connecticut will never have official returns of her street railways as a whole relating to capitalization and debt which will be of the slightest value. For an example, not long ago some $12,000,000 of trolley obligations of a single class were converted by outside holders, for the most part living in Massachusetts, into stock of the steam corporation. It is incidentally to be noted that, of the trolley lines in the state still making capitalization returns, outstanding stock and debt represent about $102,000 per mile or nearly double the capitalization in Massachusetts, where the general rule of replacement value has prevailed as a basis for capitalization. Nevertheless, historically, only one trolley corporation in Connecticut has gone under a receivership while many companies have done so in Massachusetts. The paradox is accounted for largely by the fact that in Connecticut the New Haven and the Connecticut Railway & Lighting Company have "carried" the weak and subsidiary lines.

Results of extinguished competition of steam and trolley with the absorption of parallel trolley lines by the big steam corporation are suggested by an increase of trolley passengers from 127,701,425 in the fiscal year 1907 to 138,530,816 in 1908, an increase of 10,829,391 or about 8.5 per cent., while during the same period steam railway passengers, reported by the New Haven Company, increased only from 76,687,838 to 77,145,337, or a little more than one half of one per cent. The year, ending June 30, 1908, included six months of acute business depression. But the increased trolley traffic in Connecticut, due to diminished rivalry must be qualified by the fact that in general street railways suffered less from hard times than the steam roads.

A UNIQUE EXCURSION CAR.

The South Dakota Central has had an unique passenger car built by Hotchkiss, Blue & Co., Railway Exchange building, Chicago. The car has a Pullman body, is 60 ft. long, and has a seating capacity of 160 persons. This large seating capacity, as shown by the illustration, is secured by placing four benches the full length of the car. The benches are finished in hard pine. The car is to be used for handling excursion parties and hauling workmen. It was built at the works of Hotchkiss, Blue & Co., Harvey, Ill. The following gives some of its special equipment: Interior finish, imitation mahogany; light, 4 double chandelier lamps; curtains, new Pantasote; heating, 2 Spear stoves; trucks, 6-wheel, steel tired; air brakes, Westinghouse; toilet, one.



Excursion Car on the South Dakota Central.

TRAIN ACCIDENTS IN JANUARY.[1]

Following is a list of the most notable train accidents that occurred on the railways of the United States in the month of January, 1909. This record is intended to include usually only those accidents which result in fatal injury to a passenger or an employee or which are of special interest to operating officers. It is based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to write to the railway manager for details or for confirmation.

TRAIN ACCIDENTS IN THE UNITED STATES IN JANUARY, 1909.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	No. persons reported Inj'd.
4.	St. L. & S. F.	Fisher, Okla.	bc.	P. & Ft.	2	20
8.	Boston & Me.	Holfis.	bc.	P. & P.	0	4
14.	Chic. & N. W.	Chicago.	rc.	P. & P.	1	6
†15.	Denver & R. G.	Dotsero.	rc.	P. & Ft.	25	45
16.	Chic. & N. W.	Peoria.	bc.	Ft. & Ft.	3	0
†22.	Pennsylvania	Summerhill.	rc.	P. & P.	3	6
29.	Pitts. & L. Erie.	Beaver Falls.	xc.	Ft. & Ft.	1	4

Derailments.

Date.	Road.	Place.	Cause of derlmt.	Kind of train.	No. persons reported Kil'd.	No. persons reported Inj'd.
3.	Phila. & Rdg.	Trenton.	runaway.	Pass.	0	1
5.	Ches. & Ohio.	Caperton, W.Va.	ms	Pass.	2	3
7.	Great Nor.	Bellingham.	malice.	Pass.	1	1
12.	M., K. & Texas.	Hamburg, Mo.	b. truck.	Pass.	0	22
26.	Pennsylvania	Adams Mills.	b. rail.	Pass.	0	8
†26.	Union Pacific.	Dana.	d. track.	Pass.	1	30
28.	Southern	New Albany.	d. rail.	Pass.	0	20
30.	Union Pacific.	North Platte.	d. switch.	Pass.	1	1

The butting collision at Dotsero, Col., on the evening of the 15th, was between a westbound passenger train and an eastbound freight. It occurred at 9.47 o'clock. Twenty-four passengers and one employee were killed or fatally injured and thirty-five passengers and ten employees were injured. The passenger train had an order to wait at Dotsero until 9:55, but, in violation of the order, passed there at 9:46 and met the freight about 80 rods west of the west switch. The passenger train consisted of engine, tender, baggage car, two coaches, 2 tourist sleeping cars, 1 dining car and 3 standard sleeping cars. The freight was drawn by two engines. The passenger train was running down grade at 30 miles an hour and the collision was unusually violent, two of the engines, minus their wheels, being left standing locked together in a vertical position. Most of the persons killed were in the chair car and the tourist car, both of which were completely wrecked. The collision occurred on a curve where a high bluff made the view very short. The passenger engineman and conductor are said to have been experienced men.

The rear collision near Summerhill, Pa., on the 23d occurred about 1 a.m. It resulted in the death of one passenger, one Pullman car conductor and one Pullman porter, and the injury of two passengers, four mail clerks and a fireman. The second section of westbound passenger train No. 21 ran into the rear of the preceding section, which had been stopped by freight trains ahead, and the rear car of the first section, a parlor car, was completely wrecked. The three persons killed were in this car, and they were the only persons in it. The engine of the second train and the second car were badly damaged, but the first car—a new steel mail car—was but slightly damaged.

The butting collision near Fisher, Okla., on the 4th was between a westbound passenger train and an eastbound freight, and three engines were badly wrecked. There was a dense fog at the time and neither train was visible from the other until a few seconds before the collision. One engineman was killed and three trainmen were injured. The collision was due to inefficient flagging. The freight had stopped for lack of steam and had sent a man forward to call the passenger engine to its assistance. But after the flagman had gone the men in charge of the freight got up steam and started ahead.

The butting collision near Peoria, Ill., on the 16th was between two extra freight trains and both were going at full speed. Both engines were badly wrecked and one engineman, one fireman and two brakemen were killed, and two employees were injured. The collision was due to the error of the conductor and the engineman of the northbound train. The engineman assumed that the southbound train, which he had orders to meet, had arrived. His coonductor told him that the trains which they were to meet had arrived and he then started out without consulting the register.

The derailment at Adams Mills, Ohio, on the 26th was caused by a broken rail. The train was running at full speed and two cars went off the track, but all of the injuries to persons were reported as slight.

The derailment at Dana, Wyo., on the 26th was reported as due to a loose rail, left loose by the negligence of track repairers. Five coaches were ditched.

The derailment at Hamburg, Mo., on the 12th was reported as caused by a broken truck. Seven cars were overturned. The accounts say that the only available help in the distress of the passengers had to be called by telephone from St. Charles, 36 miles away.

Only three street car accidents reported in the newspapers in January were of marked severity, one each at Portland, Ore., Los Angeles, Cal., and Cincinnati, Ohio. All were runaways. At Los Angeles the runaway car ran into the side of a passenger train. Each of the other two caused a considerable number of injuries, one or more being fatal in each accident.

Four serious passenger train derailments were reported in Canada in January. In the Frazer canyon, on the Pacific coast, a Canadian train was precipitated into Frazer river and two enginemen were killed. On the Grand Trunk, near Guelph, a car derailed by a broken truck fell down a bank and 20 passengers were injured. On the Temiskaming & Northern Ontario a part of a passenger train fell down a bank and 20 passengers were injured. On the Intercolonial near Campbellton, N. B., a whole train was ditched and one engineman was killed.

FREIGHT TRAFFIC ON THE ILLINOIS TRACTION SYSTEM.

The Illinois Traction System, operating 419 miles and running from St. Louis to Peoria and Danville, owns and operates 18 express motor cars, 40 express trailers, 12 electric locomotives and about 500 box and gondola cars. Nearly 20 per cent. of the gross earnings come from freight and express business, and of this business 60 per cent. is in the form of package freight handled on express cars and 40 per cent. heavy freight handled on freight cars. The heavy freight tonnage includes coal hauled for the use of the company.

Package freight is handled by electric motor cars with trailers attached, and coal, grain and other carload freight is hauled in freight trains by electric locomotives. No interchange of freight cars is made with any steam railway, so that the freight business is entirely local. The United States Express Co. has operating privileges in the cars of the Illinois Traction. This business is handled separately from package freight, the express cars being attached to passenger trains as well as express trains.

No attempt is made to compete with steam roads for the haul of freight destined for distant points, but the rates on freight for short distances are fixed more nearly on a mileage basis than are the rates on a steam road, and in this way

[1] Abbreviations and marks used in Accident List:
rc. Rear collision——bc. Butting collision——xc, other collisions——b. Broken——d. Defective——unf, Unforeseen obstruction——unx, unexplained——derail. Open derailing switch——ms. Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc.——boiler, Explosion of boiler of locomotive on road——fire, Cars burned while running——P., or Pass., passenger train——F., or Ft., freight train (includes empty engines, work trains, etc.)——Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.

the electric company can underbid the steam company. For instance, the rate on coal from Springfield, Ill., to Decatur, 40 miles, is 40 cents a ton, or at the rate of one cent per ton-mile. The rate from Worden to Staunton, 6 miles, is 32 cents, or at the rate of 5.33 cents per ton-mile. By catering to this short-haul traffic, the average length of haul on coal is about 30 miles and the average revenue per ton-mile is 1.2 cents as against an average revenue of 0.5 cents per ton-mile received by steam roads in the same territory.

The cost of operating the freight department is estimated to be about 50 to 55 per cent. of the freight department's gross earnings.

All carload and heavy freight is handled at night between 9 p.m and 6 a.m. by regular express trains having a fast schedule. For instance, the night express out of East St. Louis and Peoria makes a through run of 175 miles in nine hours. Three nights a week refrigerator cars are run from St. Louis to Hillsboro, Springfield and Peoria, and considerable business in hauling fresh meat out of St. Louis is being developed.

Beside the night expresses there are what are called "noon runs" by express trains that leave Peoria, Bloomington, Decatur, Danville, Springfield and East St. Louis at about noon and carry small package freight. A merchant in a small town on the line can thus telephone orders to St. Louis to a wholesaler and get goods delivered the same afternoon.

The electric locomotives in the heavy freight service are fitted with 73-C motors, with type M control automatic couplers and Westinghouse E. L. automatic air brakes. The body is sheathed with steel. The gear ratio is 17 to 73, and the locomotive is said to be capable of hauling 14 loaded cars at 20 miles an hour.

PURCHASE OF RAILWAY COAL.

At the January meeting of the Western Railway Club Eugene McAuliffe, fuel agent of the Rock Island, read a paper on the "Purchase of Railway Coal," in which he pointed out the expense to railways due to the irregular supply of coal and the necessity of storage. He said:

"There is plenty of coal, but the mines do not work as regularly as they should, and they cannot be depended on for smooth operation. Every two years it is the fashion of the miners to take a ten weeks' vacation, and the next one is due March 31, 1910. A few months before that time the miners get out about double the usual quantity of coal to tide over the consumer during the strike period, but he does not do it intentionally; he works for money to tide himself and family over; but the result is the same. The real loser is the consumer, the loss to the railways in storing coal, including labor, depreciation of coal, with consequent increase in operating expenses, all amounting to 40 or 50 cents per ton." Mr. McAuliffe suggests that something ought to be done "to avoid this biennial shutdown and prevent this waste of energy and material. If the two parties cannot agree, then a national arbitration committee should be appointed or a conciliation law, like that in force in Canada, should be enacted."

The quantity of coal used by railways in the United States in 1907 was 115,000,000 tons, or 24 per cent. of the total coal mined in the United States; and a day's consumption equals 7,876 forty-ton cars, or a train 60 miles long.

Fuel contracts should not be given as a reward for commercial tonnage, for when you get the contractor's tonnage you are liable to lose that of his competitor and they both pay the same rates of freight. Quality and price coupled with reliability of delivery are the conditions that should govern. Dividing contract tonnage on a percentage basis is not a good thing either, because it eliminates all competition as to price and grade.

The empty car is always a live issue in connection with coal transportation, and, paradoxical as it may seem, coal car shortages on railways always go hand in hand with coal shortage. Plenty of coal, plenty of cars; but this is not an argument for tying up cars. In regard to inspection, Mr. McAuliffe said:

"The best inspection is that which can command on the part of the inspector the whole force of the producer's organization to the end that good coal will be produced. It is not a good thing for the purchaser to employ men to stand around coal mines looking at the coal as it goes into the cars. That means that the buyer is furnishing superintendents that the seller should provide and pay for. I intend to gradually withdraw the inspectors in my department from the mines, and, instead, put them on work that the railway company should look after. The purchase side, as well as the selling side, of the coal business calls for the application of honest principles. The livest item in the coal line to-day is the question of car lot weights, both empty and loaded. There is very little dishonesty practiced in the handling of weights of car lot coal, but there are many inaccuracies. One car has an over-weight and the next one an underweight. The one who gets good measure does not complain, but the one who suffers does. The 50-ton coal car loaded to as much as 156,000 lbs. calls for extra good track scales, well set, maintained and handled. Weight is a factor of equal importance to that of the rate when figuring freight on a car of coal; and every railway having a mileage warranting the same should have a weighing bureau with a competent man in charge. Due consideration should be given to what may be called legitimate shrinkage of coal weights particularly that of evaporation of moisture. It is possible to weigh cars accurately without uncoupling at either end, and cars cut at one end can be weighed with accuracy, provided they are stopped on the scale, with minimum expenditure of time and expense."

The paper was discussed at length by W. E. Symons, who presented a mass of statistics from the government bureaus; first, relating to the quantity of coal produced in the United States as compared with other countries and in individual states, with the value of the coal per ton at the mines. He presented statistics relating to strikes and lock-outs in the United States, showing that of all industries miners were the first in number of strikes and employees thrown out of work. The coal industry has suffered more from the result of labor troubles than any other industry in this country, and some means should be provided whereby differences between miners and their employers could be adjusted without the possibility of numerous strikes pending a revision of the wage scale. In the past 25 years 5.7 per cent. of the coal miners' strikes were settled by joint agreement and 1.6 per cent. by arbitration; and of the lock-outs 12 per cent. were settled by agreement and 2 per cent. by arbitration.

Mr. Symons also quoted from the Bulletin of the University of Illinois, relating to the weathering of coal, in which it is concluded that outdoor exposure results in a loss of heat value from 2 to 8 per cent. Dry storage has no advantage over storage in the open except with high sulphur coals. In most cases the loss in storage seems to be practically complete at the end of five months. Mr. Symons emphasized the importance of purchasing coal according to chemical composition and said:

"Assuming a ton of coal at 2,000 lbs. has 14,000 heat units and costs $2 per ton, the cost to the railway is 70 units for 1 cent; and if the coal is furnished with only 10,000 units there is an actual loss to the railway in value of the fuel of 28½ per cent. This is not only a money loss in purchasing the material, but causes poor work by the locomotive, resulting in train delays, overtime work of crews and increased boiler repairs. The railways would not tolerate this method of purchasing in such supplies as ties, lumber, paint, rails, car wheels, etc.; but the fuel item, which constitutes about 12 to 14 per cent. of the operating expense, is given very little attention on the majority of lines and on some is almost ignored."

General News Section.

Registered mail is now carried between Chicago and New York on the Twentieth Century Limited of the New York Central lines.

The Oregon legislature has passed a resolution proposing an amendment of the state constitution to enable the state to own and build railways. In the discussion of the resolution, E. H. Harriman was accused of refraining from developing lines that he controls in central Oregon, and also of preventing other lines from being built in that section.

The United States Civil Service Commission announces an examination on March 10-11, 1909, to secure eligibles from which to appoint civil engineers in the Philippine service. The entrance salary is usually $1,400 a year. It especially wants men who have had experience in river or harbor work to fill two positions, one at $1,800 and one at $2,000 a year.

At New York City, February 17, Charles R. Stocker, a passenger conductor of the New York, New Haven & Hartford, running a through night train between New York and Boston, was arrested on a charge of violating the Interstate Commerce law in carrying two passengers through from Boston to New York for $2 apiece, which is less than half the regular fare; and berths were thrown in. Stocker had been suspected and two detectives and an agent of the Interstate Commerce Commission were put on the train to test him. One of the three men paid full cash fare—$4.65. The significant difference between arresting a dishonest conductor under state laws and under the federal law lies in the much greater penalty prescribed by the federal law, the maximum being $5,000 fine or two years imprisonment, or both fine and imprisonment. Also federal prosecutors are known to be very persistent in their prosecutions.

At Delmar, Del., on the morning of February 22, about 3 o'clock, a southbound passenger train of the Pennsylvania Railroad collided with two locomotives standing on the main track, and the engines and the first two cars of the passenger train were wrecked. One engineman, one baggageman, one express messenger and four mail car employees were killed, most or all of them being burned to death in the fire which immediately enveloped the wreck, having been started by coals from one of the fireboxes. The two standing engines were waiting to take this or a following passenger train south over the New York, Philadelphia & Norfolk. Why they were on the main track without protection has not been explained. According to one statement, the men in the yard understood that the passenger train, which was a second section, was 15 minutes behind the first section, whereas it was actually only about four minutes behind.

Safety Valves.

The discussion on safety valves given before the American Society of Mechanical Engineers at a meeting in New York City, on Feb. 23, impressed upon the society the vital need for the appointment of a research committee, the duty of which should be to conduct investigations with the view of settling upon some standard method for determining a basis on which to calculate the size and rating of safety valves. It was noticeable that there were as many seemingly correct opinions as there were speakers. Various rules and formulas were suggested, such as basing calculations on the grate surface, on the effective lift of the valve or on the discharge. Perhaps the most convincing arguments were those given by P. G. Darling, Mechanical Engineer of the Ashcroft Manufacturing Co., New York, in an exhaustive paper covering the results of a large number of tests. The main point of this paper was that the factor of safety of a valve is its capacity, disregarding mechanical reliability. Tests were made upon a number of standard makes of valves to determine the lifts which they really had. These valves were commercially rated as being of the same capacity, but the tests showed a great variation in the lifts even as much as 300 per cent. The point was made that the capacity of safety valves should be determined in terms of the effective diameter and lift.

The discussion brought out an opinion which seems to be a very sound one—namely, that if the manufacturers of safety valves would indicate, in addition to the size of the valve, its capacity at different adjustments for exhausting steam, it would help conditions materially, both from the standpoint of the manufacturers of boilers and inspectors. The subject of valve springs was gone into at some length by A. B. Carhart, Superintendent, Crosby Steam Gage & Valve Co., Boston, Mass., who advocated that valves should not be rated according to their discharge or capacity alone, taking a practically opposite standpoint from previous speakers. The question of round or square section wire for springs was also discussed, and there seemed to be as many advocates of the square section as of the round.

The final result of the discussion was that there are available no reliable data upon which to base calculations of safety valves, and that a research committee, such as will undoubtedly be appointed in the near future by the American Society of Mechanical Engineers, will have a large amount of work before it.

Complete abstracts of the papers and discussion given at this meeting will appear in the *Railroad Age Gazette* in an early issue, and will contain a large amount of information and data which will assist materially in the understanding of a subject not now very well understood.

The Mauretania's New Speed Record.

The Cunard steamship Mauretania arrived at the lightship off Sandy Hook on Thursday, February 11, at 10.35 p.m., having made the run from Daunts rock, Queenstown, 2,890 miles, in four days, 17 hours, 50 minutes. For the last two days strong head winds were encountered. This is one hour 46 minutes less than the best previous record, which was made by the Lusitania. The Mauretania left Liverpool on Saturday night, February 13, and Queenstown Sunday morning. She could not land her passengers in New York until Friday morning, as the deep channel at the entrance of the harbor has not yet been lighted and cannot be used at night by large vessels. In the 25 hours from noon Sunday to noon Monday the Mauretania made 671 knots, or an average of nearly 31 miles an hour, as we measure on land. This is 21 knots better than the best previous day's record, which was made by the Lusitania last August.

Electric Passenger Trains in Colorado.

The Inter-Mountain Railway now runs trains by electric power between Denver, Colo., and Golden, 13 miles. Steam engines are still used for freight trains. The branch of this road from Denver to Barnum, five miles long, already had electric power.

Chinese Railways.

The Canton authorities have received instructions from the ministry of posts and communications to open a railway college and admit a number of students there to be trained for three years. On the completion of their course of study in Canton the students will be sent to foreign countries to pursue further studies in railway engineering for a period of three years.

A company has been organized with sufficient capital to build a railway from Tam Sui to Au Tou, in the province of Kwangtung. Work on this road was ordered to begin during October, 1908.

It is reported that the gentry and wealthy merchants of Shantung propose to build a railway from Fushan to Weishan, a distance of 40 miles, with a capital of $80,000, which will be divided into 16,000 shares at $5 per share. The capital

will be increased in due course. A deputy has been sent to that port to canvass for 1,000 shares.

The concession for the Canton-Macao Railway has been canceled by the Chinese government, with the sanction of the Portuguese minister, as the concessionaires have failed to construct the line within the stipulated time. The Portuguese minister at Peking has agreed that a Chinese company may build this line.

It is stated that the proposed railway extension of the line connecting with the Pinghsiang mine is to be undertaken by the Canton-Hankow Railway Company. The Pinghsiang coal mine proposed to make this extension on their line from Chuchow to Shanshan, but the Hunan division of the Canton-Hankow Railway considered that this line should be built by the railway company as part of the main line. The necessary consent of the board of posts and communications has already been obtained.

It is said that the Canton-Kowloon Railway will be in a position before many months to accept tenders for rolling stock on their line, and that they will receive bids from all companies wishing to forward estimates for construction cars and general railway supplies.—*Consular Report.*

Railway Business Association.

The story of four months' accomplishment by this association since the time of the conception, in the minds of a number of supply manufacturers, of a plan to conserve the interests of railways and those of its members who are dependent for their business on railway prosperity, is interestingly told in a pamphlet just issued. The methods employed and the actual results obtained are given along with the list of membership, to date, which follows:

Adams & Westlake Co., Chicago.
Ajax Forge Co., Chicago.
Allis-Chalmers Co., Milwaukee, Wis.
American Brake-Shoe & Foundry Co., New York.
American Locomotive Co., New York.
American Steel Foundries, Chicago.
American Locomotive Finished Material Co., Atchison, Kan.
American Balance Valve Co., Jersey Shore, Pa.
American Brake Co., St. Louis, Mo.
American Valve & Meter Co., Cincinnati, Ohio.
Anglo-American Varnish Co., Newark, N. J.

Baldwin Locomotive Works, Philadelphia, Pa.
Barney & Smith Car Co., Dayton, Ohio.
Bass Foundry & Machine Co., The, Fort Wayne, Ind.
Beaver Dam Malleable Iron Co., Beaver Dam., Wis.
Bettendorf Axle Co., Davenport, Iowa.
Boston Belting Co., Boston, Mass.
Bowser, S. F., Co., Inc., Fort Wayne, Ind.
Bradley, Osgood, & Sons, Worcester, Mass.
Bridgeport Malleable Iron Co., Bridgeport, Conn.
Buckeye Steel Castings Co., Columbus, Ohio.
Buda Foundry & Manufacturing Co., Chicago.
Buffalo Brake-Beam Co., New York.

Camel Co., Chicago.
Central Railway Signal Co., Pittsburgh, Pa.
Chicago Pneumatic Tool Co., Chicago.
Chase, L. C., & Co., Boston, Mass.
Chicago Railway Equipment Co., Chicago.
Cleveland Frog & Crossing Co., Cleveland, Ohio.
Columbia Nut & Bolt Co., Inc., Bridgeport, Conn.
Commonwealth Steel Co., St. Louis, Mo.
Crerar, Adams & Co., Chicago.
Curtain Supply Co., Chicago.

Dayton Malleable Iron Co., Dayton, Ohio.
Dayton Manufacturing Co., Dayton, Ohio.
Dearborn Drug & Chemical Works, Chicago.
Devoe, F. W., & C. T. Raynolds Co., New York.
Dickson Car Wheel Co., Houston, Texas.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Farlow Draft Gear Co., Baltimore, Md.
Fairbanks, Morse & Co., Chicago
Flannery Bolt Co., Pittsburgh, Pa.
Flood & Conklin Co., Newark, N. J.
Franklin Railway Supply Co., Franklin, Pa.

Galena Signal Oil Co., Franklin, Pa.
General Electric Co., New York.
Gifford-Wood Co., Hudson, N. Y., and Chicago.
Gold Car Heating & Lighting Co., New York.
Gould Coupler Co., New York.
Griffin Wheel Co., Chicago.

Hammett, H. C., Troy, N. Y.
Haskell & Barker Car Co., Michigan City, Ind.
Hibbard, Spencer, Bartlett & Co., Chicago.
Hunt-Spiller Manufacturing Corporation, South Boston, Mass.
Hunt, Robert W., & Co., Chicago.
Hutchins Car Roofing Co., Detroit, Mich.

Independent Pneumatic Tool Co., Chicago.
International Steam Pump Co., New York.
Inland Steel Co., Chicago.
Interstate Iron & Steel Co., Chicago.

Jenkins Bros., New York.
Johns-Manville, H. W., Co., New York
Joseph, Isaac, Iron Co., Cincinnati, Ohio.

Kay & Ess Co., Dayton, Ohio.
Keasbey & Mattison Co., Ambler, Pa.
Keith Car & Manufacturing Co., Sagamore, Mass.
Kerite Insulated Wire & Cable Co., New York.
Kirby Equipment Co., Chicago.

Long, Charles R., Jr., Co., Louisville, Ky.

Manning, Maxwell & Moore, Inc., New York.
Maryland Car Wheel Works, Baltimore, Md.
McConway & Torley Co., Pittsburgh, Pa.
McKay, The James, Co., Pittsburgh, Pa.
Metal Plated Car & Lumber Co., New York.
Miner, W. H., Co., Chicago.
Morden Frog & Crossing Works, Chicago.
Mt. Vernon Car Manufacturing Co., Mt. Vernon, Ill.

Nathan Manufacturing Co., New York
National Lock Washer Co., Newark, N. J.
National Machinery Co., Tiffin, Ohio.
National Malleable Castings Co., Cleveland, Ohio.
New York Air Brake Co., New York.
New York Belting & Packing Co., Ltd., New York.
Niles-Bement-Pond Co., New York.

Pantasote Co., New York.
Parkesburg Iron Co., Parkesburg, Pa.
Patterson-Sargent Co., Cleveland, Ohio.
Peerless Rubber Manufacturing Co., New York.
Pettibone, Mulliken & Co., Chicago.
Pickands, Brown & Co., Chicago.
Pittsburgh Spring & Steel Co., Pittsburgh, Pa.
Portland Iron & Steel Co., Boston, Mass.
Pneumatic Gate Co., Chicago.
Pratt & Lambert, Inc., Buffalo, N. Y.
Pratt & Letchworth Co., Buffalo, N. Y.
Prentice, L. H., Co., Chicago.
Pyle-National Electric Headlight Co., Chicago.

Quaker City Rubber Co., Philadelphia, Pa.

Railroad Supply Co., Chicago.
Rand, McNally & Co., Chicago.
Ramapo Iron Works, Hillburn, N. Y.
Republic Iron & Steel Co., Pittsburgh, Pa.
Rodger Ballast Car Co., Chicago.

Safety Car Heating & Lighting Co., New York.
Schieren, Charles A., Co., New York.
Scully Steel & Iron Co., Chicago.
Sellers, William, & Co., Inc., Philadelphia, Pa.
Sherburne & Co., Boston, Mass.
Sherwin-Williams Co., Cleveland, Ohio.
Simmons Hardware Co., St. Louis, Mo.
Sipe, James B., & Co., Pittsburgh, Pa.
Standard Car Truck Co., Chicago.
Standard Coupler Co., New York.
Standard Railway Equipment Co., Pittsburgh, Pa.
Standard Steel Car Co., New York.
Storrs Mica Co., Owego, N. Y.

Treat, C. A., Manufacturing Co., Hannibal, Mo.
Tyler Tube & Pipe Co., Washington, Pa.

Union Steel Casting Co., Pittsburgh, Pa.
Union Switch & Signal Co., Swissvale, Pa.
U. S. Metal & Manufacturing Co., New York.
U. S. Metallic Packing Co., Philadelphia, Pa.

Walsh, P. T., Davenport, Iowa.
Ward Equipment Co., New York.
Western Electric Co., New York.
Westinghouse Air Brake Co., Pittsburgh, Pa.
Westinghouse, Church, Kerr & Co., New York.
Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
White Enamel Refrigerator Co., St. Paul, Minn.
Wood, Guilford S., Chicago.
Worth Bros. Co., Coatesville, Pa.
Wyckoff Pipe & Creosoting Co., New York.

Courtesy on the Harriman Lines.

M. J. Buckley, General Superintendent; R. B. Miller, General Freight Agent, and William McMurray, General Passenger Agent, of the Oregon Railroad & Navigation Company and the Southern Pacific lines in Oregon, with the approval of J. P. O'Brien, Vice-President and General Manager, have issued the following circular on courtesy:

"TO EMPLOYEES ON THE LINE:

"Courtesy costs nothing and yields large returns. Cordial relations with customers are an asset. You increase this property's value to owners and patrons, as well as the value of your service, by making friends.

"Rules necessary in a business so complex cause less dissatisfaction than unfortunate methods of enforcement. Your training renders familiar to you matters not understood by the public, and inquirers are entitled to prompt, courteous and complete replies. If something seems at fault beyond your power to correct, explain how and through whom to seek the remedy. Manner outweighs words. The salesman of transportation should make his customers as welcome as would any business man, inspiring the wish to come again.

"TO GENERAL OFFICE AND DIVISION EMPLOYEES:

"Above equally applies; and remember your duties concern one department, where you should be expert, while the 'boys out on the line' deal with requirements of all departments. Courtesy between and among you reflects credit on all, rendering easier and pleasanter the task of each.

"TO PATRONS:

"The management's wishes and instructions are published for information. It is hoped complaints may never, and believed they will seldom, be necessary.

"If received they will be vigorously investigated and remedied."

Merits on the Atchison.

The Santa Fe Employees' Magazine gives a statement of merit marks placed to the credit of various employees on the Atchison, Topeka & Santa Fe within a recent month. We copy some of the less common kind of items:

Miss N. Gazot, operator, Albuquerque Division, ten. Miss Gazot overheard a message sent to another office instructing conductor to pick up loads at her station. When conductor arrived and reported ready she asked him if he was not going to get out the loads. He said he had no instructions to do so. She obtained copy of message and delivered it, thus preventing serious delay to important freight.

O. G. Fuller, brakeman, Pecos Valley Lines, fifteen, for discovering bent axle under car.

T. Cole, conductor, and E. G. Fletcher, brakeman, Southern Division, five each, for sanding rail up a hill to avoid doubling.

R. G. Randolph, operator, Lamar, Colo., five, for reporting to despatcher that train passing his station had brakes sticking.

S. C. Underwood, fireman, Southern Division, ten, in appreciation of good work performed while tied up under the sixteen-hour law.

C. E. Ray, agent, Valley Division, five, for stopping a train under which a brake-beam was dragging, thus preventing a possible serious accident.

C. Turner, engineer, Los Angeles Division, five, in appreciation of unusual repairs made on an engine while on the road. In this instance the pipe broke off the front end of the main reservoir, and engineer made repairs by cutting a piece of pipe out of the reservoir with a chisel and filing threads on the part that remained, doing the work while on a siding waiting for an opposing train.

The Average P. R. R. Engineman.

Statistics compiled by the Pennsylvania Railroad January 1, 1909, show that the average age of its 4,802 enginemen is 44 years, and the average length of service 21 years. The average age at which they were appointed enginemen was 31 years, while the age at which they entered the service was 23 years. Included in these figures are 134 enginemen who have been retired from active service and are now reciving pensions granted them by the company. Their average age is 72 years. Up to the time they were retired these men had served the company an average of 43 years, 36 of which had been spent as enginemen. Their present retired pay amounts to 43 per cent. of the average wages for ten years preceding retirement.

New York Central Rails.

The rails recently ordered by the New York Central are being rolled under the tentative specifications which the company prepared for its 1908 rails. They are arranged to secure, as far as possible, the best principles of Bessemer practice. The rails made last year under these specifications were much better than those received immediately previously.

It is difficult to make any specifications with a sufficient carbon content, with the 0.10 phosphorus which the company has to accept, to give the rails such physical properties that they can withstand the severe abrasion on curves, and also have a slow rate of wear. The first consideration has been safety, and that factor has been markedly increased. There will also be some improvement in the resistance to abrasion on curves, and also to wheel tread wear. The company is sure that it will reduce the number of rails which, after four or five years service, develop split heads. Last year there was a marked reduction in second quality rails, the mills in that way co-operating with the railway.

This year the company wants to carry out more systematically the specifications of 1908 to see what the uniform improvement in the quality of the rails will be. Then it will prepare specifications indicating the general lines of Bessemer practice which it is willing to accept. It does not want to introduce anything in its specifications except what it considers essential to good practice with large output. The high-grade rails made 10 to 16 years ago gave excellent service. These rails are in many cases still in track and do not wear rapidly on tangents, abrade on curves or fail as girders. The mills have been asked to make the new rails, as far as they can with the change in ores, similar to those rails made many years ago. The rail section has not been changed. The company considers that the first requisite is to get a reasonable Bessemer practice which will tend to make a good quality of steel in sound ingots, and then roll it so as not to injure the metal in the rolling. To get a better quality of rail, it had to introduce some tentative conditions which restrict the output for these trials. Rolling differs so much in the different mills that it has been very hard to adjust all these different conditions among them. The company does not intend to make the specifications public for a year or two, as it wants first to make sure that the specifications are satisfactory.

Central and Western Association of Car Service Officers.

The Central and Western Associations of Car Service Officers met in Chicago on February 18. F. M. Luce (C. & N. W.) was chairman of a committee that made a report on "Discrepancies in Interchange Accounts." Mr. Luce said that the number and aggregate amount of such discrepancies had been much reduced by the harmonious efforts of car service officers. His office is reporting 98 per cent. of per diem within a month after it accrued. The members were requested to prepare detailed figures showing unsettled per diem at the end of 1908.

A recommendation was adopted that hereafter the receiving road prove the accuracy of its records instead of requiring the delivering line to prove the accuracy of its records, the owner of the car, where the car does not belong to either the delivering or receiving line, not to be brought into any such controversy.

A committee, of which W. M. Harvey (C., M. & St. P.) was chairman, reported on the equated system of tonnage. The report indicated that while there is general agreement as to the desirability of equated tonnage, those who report tonnage do not always make their reports accurate, and railway officers are equally careless in requiring accurate reports.

J. M. Daly (I. C.) described what is being done to collect information at Chicago regarding interchange and inspection of cars, with a view to determining if the establishment of a joint interchange and inspection bureau is desirable.

G. H. Waldo (C., H. & D.) told what is being done along the same line at Indianapolis and Cincinnati. He said it was proposed to establish at Cincinnati in addition to an interchange bureau one local record to show the arrival, the transfer and the departure of all cars. All roads would have access to this record and would abolish their individual records.

The following officers for the ensuing year were elected: President, J. W. Nowers (A., T. & S. F.); Vice-President, J. A. Wagner (Des Moines Union); Secretary, W. E. Beecham (C., M. & St. P.); Treasurer, F. M. Luce (C. & N. W.); Member Executive Committee, J. M. O'Day (C. & E. I.).

Average Demurrage Rule Condemned.

D'Arcy Scott, Assistant Chief Commissioner of the Railway Commission of Canada, has sustained the Canadian car service rules with regard to allowing only 48 hours under ordinary circumstances for the unloading of cars, and has refused to issue any rule by which shippers could be credited with time saved within this limit to be applied to cars held beyond the two days. The Wallaceburg Sugar Company asked for an order establishing in Canada what is generally known as the average demurrage plan, or practically the setting off of overtime on some cars against the speedier unloading of others. The board ruled that the car service rules, giving the straight 48 hours for unloading, without demurrage either way, were in the interest of all shippers, big or small, and therefore dismissed the application. In his decision Mr. Scott said: "The average system might have the effect of making a consignee dilatory about unloading so long as he had free time to his credit, and if he had not free time to his credit the circumstances would be the same as they are under the present rules. If the average plan were in force, I can well see

that an injustice would be done the small dealer. Suppose a dealer with a large capacity for storage received 50 cars of merchandise, which under the rules he has two days to unload, and unloaded them all the first day. He would then have 50 days to his credit. The next day, he and a small competitor each received one car. The small competitor would have to unload in two days or be penalized, while the other could hold his car for 50 days, free time, which might prove to be a very material advantage. * * * If the applicant cannot get redress under the rules from the Car Service Bureau, he may apply to this board, and his complaint will be heard. Application should be dismissed."

Moving Platform Proposition.

The Continuous Transit Securities Company, of 45 Broadway, New York, has petitioned the State Public Service Commission for the invitation of proposals for the construction of eight lines of continuous railways or moving platforms from various points in Manhattan. Important financial interests are said to be back of the company. As outlined by the company, the proposed routes are four, extending in all directions, the most important being on Broadway from 14th to 42d street. The company proposes that connections be made, whenever practicable, at points where the routes proposed cross or closely approach existing transportation lines. Should the commission decide favorably upon the proposed plan the Securities Company stands ready to bid on the construction of the different routes.

Max E. Schmidt, President of the company, expects to get the right for at least one of the routes, preferably the one under Broadway above mentioned. The matter of the location of stations or the question of fare has not yet been taken up. Besides Mr. Schmidt, the directors of the company are Albert R. Gallatin, A. Polhemus Cobb, David L. Gallup and Eads E. Schmidt.

Chicago Street Railway Improvements.

Plans for continuing the rehabilitation of the Chicago Railways Co. during 1909 have been announced. Over $11,000,000 is to be spent this year. The work includes the rebuilding of 112 miles of track, at a cost of $5,040,000; the purchase of 350 double-truck pay-as-you-enter cars to cost $2,100,000; new underground system, $1,252,983; completing the car barn at Lincoln and Wrightwood avenues, $81,000; building car barn at the city limits, $192,530; car barn at Kedzie avenue and Van Buren street, $465,885; car barn at Twenty-second street and Ogden avenue, $313,000; car barn at North and Forty-eighth avenues, $457,750; erecting new car shops, $350,000; new rotaries for substations, $450,000; new trolley construction, $363,840. The car barn at the city limits will accommodate 89 double-truck cars and will have club room facilities for employes, men's quarters, etc. The Wrightwood and Lincoln avenue barn will have a capacity for 95 double-truck cars; the Kedzie avenue station, 291 cars; the Twenty-second street and Ogden avenue station, 214 cars; and the North and Forty-eighth avenues station, 360 double-truck cars. Bids have been received on the 350 pay-as-you-enter cars.

Melville, the Metropolis.

Another metropolis is springing up on the prairies of western Canada. A year ago there was a spot on the line of the Grand Trunk Pacific without a name or any special significance. But on that spot has sprung up Melville, the operating center for nearly 1,000 miles of the Grand Trunk Pacific, and already its population numbers over 1,200 people, with modern houses, stores and hotels. In six months its population will have doubled and by the end of the present year it is confidently expected 4,000 people will be living in the future distributing point of western Canada. Melville is the center of the richest farming country of Saskatchewan. A branch line is to be built this spring to Regina, and another northward toward Hudson's Bay.

In addition to all this, the boomers of the future metropolis can see, in their mind's eye, a great movement of grain through Hudson's Bay to Europe—great enough to put Duluth and Chicago in the shade.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; May 11-14, 1909; Richmond, Va.
AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; May 11; St. Louis, Mo
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th street, New York; second Friday in month; New York.
AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Pl., New York; May 19, 1909; New York.
AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.; Oct. 19, 1909; Jacksonville, Fla.
AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago; March 16-18, 1909; Chicago.
AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 16-18, 1909; Atlantic City.
AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St., N. Y.; 1st and 3d Wed., except July and Aug.; New York.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., N.Y.; 2d Tues. in month; annual, Dec. 7-10; New York.
AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York.
ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 28, 1909; Cincinnati.
ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A., T. & S. F., Topeka, Kan.; last week in May, 1909; Detroit, Mich.
ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS—P. W. Drew, Wisconsin Central Ry., Chicago; June 23-25, 1909; Detroit.
ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York; June 22-23; Montreal.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.
FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909; Old Point Comfort, Va.
INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., N. Y.; April 27-30, 1909; Louisville, Ky.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; June 21-23, 1909; Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—E. C. Cook, Royal Insurance Bldg., Chicago; June 1-5; Chicago.
IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 21-23, 1909; Atlantic City.
NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in mnth, ex. June, July, Aug. and Sept.; Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August; New York.
NORTH-WEST RAILWAY CLUB.—T. W. Flannagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, Aug.; St. Paul and Minn.
RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June July and August; Pittsburgh.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; March 15, 1909; Chicago.
RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; May 17-19; Chicago.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Nov., 1909; Washington.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—J. H. O'Donnell, Bogalusa, La.; April 15; Atlanta, Ga.
SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.; September, 1909; Denver.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month, except June, July and August; Chicago.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Omaha Railway Club.

At a meeting of subscribers to membership in the new Omaha Railway Club, the following officers were elected: President, J. A. Munroe, Freight Traffic Manager, Union Pacific; Vice-Presidents, C. E. Spens, General Freight Agent, Burlington, and S. F. Miller, General Freight and Passenger Agent, North Western; Treasurer, L. Beindorff, City Passenger and Ticket Agent, Union Pacific; Secretary, W. P. Stillman, Chief Clerk, Union Station.

The purpose of the club is stated to be "to promote personal acquaintance, social intercourse, the advancement of the professional and personal interests of its members, and the forwarding of the interests of the railways entering Omaha, having due regard for the rights of the general public."

New York Railroad Club.

At the regular meeting of this club on February 19 the topic was "The Bureau for the Safe Transportation of Explosives," and a paper by Colonel B. W. Dunn was presented. Colonel Dunn dealt with the details of the operation of the bureau, with which the readers of the *Railroad Age Gazette* have already been made acquainted.

Canadian Society of Civil Engineers.

At a sectional meeting on February 25, a paper entitled "Phototopography," by P. W. Greene, was read, and illustrated with lantern slides.

Traffic News.

A bill has been introduced in the Kansas legislature to reduce the freight rates on a large number of commodities 15 to 20 per cent.

The Puget Sound fast mail of the Great Northern will start from St. Paul at 10.20 p.m. daily, beginning February 28, instead of at 3 p.m. This will enable the Badger State express of the North Western, which leaves Chicago at 9 a.m. daily, to connect with it at St. Paul.

The State Railroad Commission of Ohio has allowed the Baltimore & Ohio and the Baltimore & Ohio Southwestern to suspend, until May 31, the demurrage rules on coal cars loaded with coal and held at mines waiting billing instructions. This is done to give employment to men who otherwise would be idle.

The executive committee of the Western Passenger Association has resolved that, until executive officers act, no further rates of less than 2 cents a mile should be made by western lines, except in territory in Illinois common to the Central Passenger Association lines. The report of the executive officers will be heard on March 3, either by the executive committee or by the entire Western Passenger Association.

The Wisconsin Demurrage Bureau reports that it handled 93,633 cars in January, 1909, as compared with 77,553 cars in January, 1908. The average day's detention of cars by the railway was 0.15 this year as compared with 0.19 last year, and the average day's detention by consignee was 1.36 this year as compared with 1.66 last year. Thus the total average day's detention was 1.51 in 1909 as compared with 1.85 in 1908.

The Dominion Government Engineer has officially stated that with the dam now completed at St. Andrew's Locks the channel of the Red river will be opened for vessels as soon as the ice breaks up this spring, enabling craft of all kinds to run through to Lake Winnipeg. Large quantities of lumber, wood and other material can now be delivered in Winnipeg at greatly reduced rates. A local company is preparing to build large docks at Winnipeg.

The Judicial Committee of the Privy Council of Canada has confirmed the decision of the railway commission requiring the Grand Trunk to run, daily, between Montreal and Toronto, at least one train having cars in which passengers may ride at 2 cents a mile. This requirement is part of the act of incorporation under which the railway was organized. Complaint was made about two years ago that the road was not performing its duty, and this order was the result.

"Milling-in-transit" is now applied not only to grain and lumber, but to iron as well; and next we shall probably hear of it in connection with grindstones and millinery if the traffic men continue to exercise their marvelous ingenuity. It was announced last week in Pittsburgh by the Wabash that iron articles shipped from that city to the West would be allowed a "stop-over privilege" for 1½ cents per 100 lbs. extra. A few days later the Hocking Valley made a similar announcement. It is said that these concessions in rates have been made for the benefit of factories at Toledo and Massillon.

The traffic on the Great Lakes during the season of 1908 was 60,518,000 net tons as compared with 83,506,991 and 75,609,648 net tons during the 1907 and 1906 seasons, respectively. The decrease in 1908 was due mainly to the falling off in shipments of iron ore, though all other principal items, except hard coal and salt, also show smaller totals than in 1907. The iron ore shipments of 1908, exclusive of 228,784 gross tons exported to Canada as reported to the Bureau of Statistics of the Department of Commerce and Labor, totaled 24,939,185 gross tons, as compared with 40,727,972 gross tons in the 1907 season. About 1,000,000 gross tons of ore are credited to the two new receiving points of Indiana Harbor and Gary, thus placing Chicago and vicinity on practically the same level as Cleveland as an ore receiving center.

The dispute between the Wabash-Pittsburgh Terminal and its competitors regarding passenger rates between Chicago and Pittsburgh has been settled. On the new basis the various lines will charge the following rates: The Pennsylvania lines, $10.50 single trip and $9.35 each for parties of ten or more; the Baltimore & Ohio and the Pittsburgh & Lake Erie, single trip, $9.50 and ten rides, $8.45; the Wabash-Pittsburgh Terminal, single trip, $9, and ten rides, $8. The Wabash-Pittsburgh Terminal heretofore has had no differential party rate, and its new party rate applies only on westbound business. The settlement also provides that during the calendar year 1909 the Wabash-Pittsburgh Terminal may run five excursions between Chicago and Pittsburgh at a rate of $9 for the round trip, but such excursions may not be run at the time of a convention or when a special rate made by the Central Passenger Association lines is in effect.

INTERSTATE COMMERCE COMMISSION.

Prescribing a Specific Rate.

Michigan Buggy Co. v. Grand Rapids & Indiana et al. Opinion by Commissioner Clark.

A joint through rate higher than the sum of the local rates of the same carriers via the same route found to be unreasonable. Reparation awarded.

As the defendant carriers have a right to increase their separate local rates, an order that the joint through rate may not, for a stated period, exceed the sum of the local rates could, by such increase in local rates, be made ineffective. A specific rate is therefore prescribed.

C. O. D. Shipments of Liquor.

Royal Brewing Co. v. Adams Express Co. et al. Opinion by Chairman Knapp.

Under date of June 15, 1907, defendants established a rule which provides that they will not undertake to collect for shippers the purchase price of intoxicating liquors—that is to say, they will not perform for that traffic what is known as "C. O. D." service. In view of the practical difficulties attending the "C. O. D." carriage of intoxicating liquors, the discrimination against that traffic resulting from the rule in question is not undue, and therefore not in violation of the statute.

Joint Rates.

Crane Railroad v. Philadelphia & Reading et al. Opinion by Chairman Knapp.

The complainant, a railway company having 1.9 miles of track, connecting the Crane Iron Works and five other industries at Catasauqua, Pa., with defendants' tracks, asked for the establishment of through routes and joint rates upon interstate shipments between points on its line and all points on defendants' lines. All the facts and circumstances disclosed did not show that the complainant is a common carrier and therefore it is not entitled to the order sought in this proceeding.

Increased Cost of Operation and Higher Rates.

Shippers' & Receivers' Bureau of Newark v. New York, Ontario & Western. Opinion by Commissioner Harlan.

An increase in the cost of labor, and in the price of railway materials and supplies, does not necessarily imply a decrease in the net earnings of a carrier or preclude the possibility even of an increase in its net earnings, due to an increase in the volume of its traffic or to a decrease in the ratio of its operating expenses to its operating revenues; nor is an increase in the cost of labor and materials, accompanied by a decrease in the net revenues of a carrier, necessarily inconsistent with the possibility that its net earnings may still

suffice to afford it a fair return on the investment without an increase in its rate schedules.

On the record the defendant's rate of $1.60 per net ton for the transportation of stone in carloads from East Branch, N. Y., to Weehawken, N. J., a distance of 150 miles, is found to be unreasonable, and a rate of $1.40 per net ton is prescribed as a maximum for the future.

Differences in Minimum Carload Weights on Connecting Lines.

J. G. Falls & Co. v. Chicago, Rock Island & Pacific et al. Opinion by Commissioner Harlan.

A carrier's own published tariffs are the measure of its obligations to shippers; it cannot be controlled by the terms of the separate tariffs of its connections. Under a local any-quantity rate a shipper has no right to demand a car of a given size; the carrier may use any available equipment, notwithstanding the fact that the separate tariffs of a connecting line provide a minimum weight under a carload rate. The initial carrier, in the absence of a definite agreement with the shipper as to the size of car to be used is not liable to the shipper for the increased rate charges imposed on him because it delivers to the connecting line in two cars a shipment, moving under the two local rates, the weight of which comes within the carload minimum weight provided in the tariffs of the connecting line.

The Commission is without authority to enter an order requiring a shipper to make good an undercharge, but shippers must understand their liability under the law for the failure or refusal to pay the published rates.

Rates on Ice Should be Very Low.

Mountain Ice Co. et al. v. Delaware, Lackawanna & Western. Opinion by Commissioner Prouty.

Defendants' rates on natural ice from points of harvest in New Jersey and Pennsylvania to various consuming interstate destinations found unreasonable, and just and reasonable maximum rates prescribed for the future, when the ice is carried in ordinary box cars. The service rendered by defendants in the movement of this traffic may properly be styled a "special" service; but it is not in any proper sense an "expedited" service, nor is it an expensive service. The value of this ice when taken up for transportation is almost nothing, and the cars readily load to their physical capacity, on the average more than 27 tons, therefore to few if any kinds of business should lower rates be applied by defendants. This is especially true since the business of complainants has been built up under much lower rates, voluntarily established and long maintained by defendants, and the investment so induced must be largely destroyed if the present rates are maintained. All that, however, would be no reason for requiring defendants to perform this service for a sum which would not fairly compensate them. Cost of service, rate per ton per mile, and other factors in making present rates have been considered and discussed; but when taken into account they still leave the present rates excessive.

Rates on Coal from the Black Mountain District of Virginia.

Black Mountain Coal Land Co. et al. v. Southern Railway et al. Opinion by Chairman Knapp.

The charge of 10 cents more per ton upon shipments of coal in carloads from the Black Mountain coal district, in the state of Virginia, than from the Apalachia district, in the same state, to Morristown, Tenn., and all points east and south thereof on defendants' lines, is unjust and unreasonable. The rates from the Apalachia coal district in Virginia, including the Black Mountain coal district, which exceed 25 cents above the rate from Coal Creek to all points on defendants' lines east and south of Morristown, Tenn., as far south as Charleston, S. C., and Augusta, Ga., unduly discriminate against the Black Mountain and Apalachia operators and unduly prefer Coal Creek operators.

A carrier cannot lawfully so group its mines with respect of rates as to unduly discriminate against any locality. The duty imposed by law is to give equal treatment to all shippers who are in position to demand it, and this includes the right to reach competitive markets on relatively equal terms. Carriers are not required by law, and could not in justice be required, to equalize natural disadvantages, such as location, cost of production, and the like. Where, however, the same carrier serves two districts which, by their location, the character of their output, and distance from markets where their product must be disposed of are in substantially similar circumstances and conditions, the serving carrier cannot lawfully prefer one to the other in any manner whatsoever.

Rates on Bananas from Central America.

D. M. Payne v. Morgan's Louisiana & Texas et al. Opinion by Commissioner Clark.

For six years bananas originating in Central America have been shipped from New Orleans, upon bills of lading executed at that point, as local traffic and under a rate that has not until now been challenged. Complainants contended that a subsequently issued tariff, applicable to "import traffic," should apply to these shipments because, technically, they were "import traffic." The bananas are not moved under any through bill of lading. No ship's manifest is issued for them. They are brought to New Orleans in ships that are owned by the grower and owner of the bananas. On arrival at New Orleans the bananas pass to the custody and possession of a selling agency which distributes them under and on local bills of lading.

Although inadvertent or careless wording of tariffs afforded some opportunity for misunderstanding and misconstruction, it is shown that the rate which is complained of and which has applied for several years was not canceled or changed during the period covered by these complaints. The period during which conflict in tariffs could be claimed extended only from February 15 to May 7, 1908. The complaint is as to shipments moved between September 3, 1906, and May 26, 1908.

The rate of 82 cents per 100 lbs. for transportation of bananas in carloads from New Orleans, La., to El Paso, Tex., is not unreasonable and reparation is denied.

Exceptions to Demurrage Charge.

American Creosoting Works, Limited, v. Illinois Central et al. Opinion by Commissioner Clark.

Manifestly it is the duty of the carrier to accommodate the needs and necessities of its shippers in regard to supplying cars as much as possible without undue discrimination; but as a practical matter it is not possible for carriers to furnish all shippers with just such cars as they would like and in such numbers and at such days and hours as would best serve the interests of shippers.

There is nothing unreasonable or unlawful about a tariff rule which provides that in the event of the carrier's bunching a shipper's cars and delivering them in excess of the shipper's facilities and ability to load or unload demurrage will not accrue.

Complainant, desiring to ship creosoted lumber from near New Orleans, La., to points in Texas, Arizona and Mexico, requested 200 empty flat cars to be delivered at the rate of four a day; these cars were not delivered as requested, but on many days no cars were furnished and on some days more than four cars were furnished. Numbers of these cars were not loaded within the free time prescribed in the Car Service Association's rules, and demurrage accrued on them. Complainant contested these demurrage charges on the ground that defendants failed to deliver the cars at the rate of four cars per day, as requested. On the whole record, the Commission is unable to find these demurrage charges were in this case unreasonable or unjust. Complaint dismissed.

If complainant had no voice in directing the setting in of more than four cars per day, or if it were shown that complainant protested against the setting in of so many at one time, and its voice and protest had been ignored, there might be room to find that the demurrage charges resulting were unjust and unreasonable; but there is, however, no such showing in the record in this case.

Reconsigning Rules.

Kile & Morgan Company v. Deepwater Railway et al. Opinion by Commissioner Clements.

Through failure of the Chesapeake & Ohio to forward a carload of lumber consigned to New Haven via Harlem river, as specifically routed by shipper, complainant was deprived of alleged privilege of reconsignment without extra charge offered by the New York, New Haven & Hartford at the Harlem river. On claim for reparation for expense of local haul from New Haven to Nashua, N. H., the point to which shipment would have been reconsigned had misrouting not occurred, it is held that since provision therefor was not filed with the Commission this reconsigning practice cannot afford basis for reparation.

A shipper cannot be deprived through a carrier's negligence of any lawful privilege offered by another carrier, but such privilege must itself be not only one which the carrier may lawfully allow, but it must also be duly established and filed with the Commission. Reconsigning rules required to be signed by shipper and subject to cancelation at the option of the carrier are inconsistent with the law governing the establishment and modification of tariff schedules.

A cause of action accrues under the act to regulate commerce on the date freight charges are paid. All claims, whether arising prior or subsequent to August 28, 1906, effective date of the act, are entitled to two years for presentation to the Commission, the one year proviso applying only to claims that accrued more than two years prior to that date.

STATE COMMISSIONS.

The Oklahoma Corporation Commission has issued an order requiring all telegraph companies in the state to file reports of the physical value of their properties by April 1.

The Railroad Commission of Indiana has ordered the reduction of rates on coal from the Brazil-Linton (Indiana) coal district to South Bend and Mishawaka. It was claimed that the roads discriminated against the Indiana towns in favor of cities outside the state, principally Chicago. Manufacturing concerns at South Bend come into direct competition with Chicago factories and the Commission held that coal moves to South Bend under as favorable transportation conditions as to Chicago, and the distance is 66 miles less, so that a rate 15 to 20 cents per ton higher to South Bend constitutes discrimination. It was held that the discrimination against South Bend and Mishawaka as in favor of Gary, Ind., Whiting and Michigan City, which take the Chicago rate, was even clearer than in favor of Chicago. The carriers object to the reduction on the ground that it would affect coal rates as far east as Buffalo, but the Commission said that the objection that it could not legally disturb a single rate because of the probable effect on other rates was not tenable.

The Texas Railroad Commission has ordered, effective on March 5, that the destination of any carload shipment originating at a point in Texas may be changed in transit at a charge of $1 per car when the substituted destination is a point in Texas in the direction of the original movement. Requests for the change must be made in writing to the agent at the first destination while the car is in transit or before demurrage accrues at first destination. When the change of destination involves a back haul or indirect service, an additional charge of 1 cent per ton per mile, with a minimum of $5 per car, may be made. If the rate to the substituted destination is higher than that to the original destination, such higher rate plus the extra service charge, if any, will apply. When the rate to the substituted destination is less than to the original destination and the order for the destination change is received before the shipment arrives at or moves beyond such substituted destination, such lower rates plus the extra service charge, if any, will apply. Only one change of destination is authorized.

Colorado. Affording Facilities to Competitors.

Gerber et al. v. Union Pacific.

The defendant had been in the habit of storing freight cars, its own and those delivered to it by other roads, on a team track in the city of Denver, known as Ryan's spur. Owing to congestion of traffic, the defendant refused to store the cars of other railway companies on this track but continued to place its own cars there for unloading and storing. In both the act to regulate common carriers in Colorado and the Interstate Commerce Commission act the respective commissions are given jurisdiction over cars furnished by any common carrier to be delivered at any station, but in the Interstate Commerce Commission act there is a further clause which adds that "this shall not be construed as requiring any such common carrier to give the use of its tracks or terminal facilities to another carrier engaged in like business," while the Colorado act has no such additional provision. The commission therefore orders that the Union Pacific set all cars, those of competitors as well as its own, on the team track when requested. Furthermore, if the privilege of using this Ryan's spur as a team track is withdrawn from some it must be withdrawn from all.

California. Unjust Rates and Discrimination.

In the matter of alleged discriminations by the Southern Pacific, the Atchison, Topeka & Santa Fe and the San Pedro, Los Angeles & Salt Lake.

It is not claimed nor does the Commission find that any of the rates, examined at an investigation as to alleged discriminations in freight rates and transportation facilities between intrastate shippers, were unreasonable. It was found, however, that there were a number of discriminations in rates by the Southern Pacific and the Atchison, several of which the Commission regards as in violation of the act of the legislature of April 1, 1878. In respect to unjust discriminations, it was found that the San Pedro, Los Angeles & Salt Lake had not been guilty of any unjust discriminations and the case against it was dismissed.

There were discriminations in rates by the Southern Pacific, some of which were found to be unquestionably cases of unjust discrimination. Others cannot be properly classed as unjust, as there was no discrimination between the parties. Secret rates, even when not discriminatory by reason of their being no competitive shipper or shippers, are condemned as tending to create monopoly and limit markets.

There were six findings of unjust discriminations against the Santa Fe. Rates on oil were found to have been legally fixed and established by the Commission and to have been disregarded by the Santa Fe, and for this offense the company was fined $5,000. In all instances except this one, the Commission found that the shipper must get redress for the alleged unjust discrimination against him only by himself proceeding against the railway under the statute.

COURT NEWS.

The Supreme Court of the United States has affirmed the validity of the clause of the Interstate Commerce Law amendments of 1906 relating to express companies and affirmed the judgment of the federal court in Chicago in enjoining six express companies from issuing franks to their employees or to other express companies. The law, said Justice Day, did not give those companies the same privileges in that regard as were given railway companies. Franks for the free transportation of goods by express are treated substantially as passes.

The Railroad Commission of Arkansas has petitioned Judge Vandeventer, of the Federal court, to dissolve the injunction restraining the Commission from enforcing or the railways from obeying its orders for reductions in rates. It is alleged that the railways have violated the spirit of the injunction by going to the extreme in exacting exorbitant charges. G. W. Swain, Rate Clerk of the Commission, has filed an affidavit with the court, estimating that the Rock Island increased its rates 71 per cent. after the granting of the injunction, the Cotton Belt 84 per cent. and the Iron Mountain 77 per cent. on grain, cotton, lumber, sand, brick, stone and merchandise, and that the increases in passenger and freight rates since the injunction was issued amount to three millions a year.

Missouri River Jobbers' Case.

The taking of testimony in the Missouri river jobbers' case was finished at Chicago on February 19. E. B. Boyd, Assistant to the Vice-Presidents of the Gould lines, contended that the order of the Interstate Commerce Commission making the through class rates from the Atlantic seaboard to Missouri river points less than the sums of the local rates was based on a false principle. No railway accepts less than the sum of its local rates for through traffic unless compelled to do so by competition or by other conditions which he must meet or not take the business. Mr. Boyd presented a large amount of data and argued at length to show that the effect of the Commission's order, if enforced without reductions in rates being made from jobbing points intermediate between the seaboard and the Missouri river, would be to greatly injure the intermediate jobbing points.

Representatives of a number of large Chicago jobbing houses appeared before Special Master in Chancery Bennett, who is taking testimony in the Missouri river jobbers' case, to oppose the reduction in proportional rates from the Atlantic seaboard to the Missouri river that has been ordered by the Interstate Commerce Commission. Two of these witnesses were Arthur Hawxhurst, Department Manager of Marshall Field & Co., and Albert G. Jones, Traffic Manager of Franklin MacVeagh & Co. Mr. Hawxhurst said that the rates fixed by the Commission would increase the handicap of Chicago in selling goods to merchants beyond the Missouri river. Mr. Jones gave similar testimony. L. B. Boswell, Commissioner of the Quincy (Illinois) Freight Bureau, testified that the reduction ordered by the Commission would be disastrous to the shippers of Quincy unless accompanied by a corresponding reduction in jobbing rates from Quincy.

New York Central Fines Affirmed.

The Supreme Court of the United States has affirmed the fines aggregating $126,000 imposed upon the New York Central and $6,000 upon Fred L. Pomeroy, Assistant Traffic Manager, for paying rebates to the American Sugar Refining Company of 5 cents per 100 lbs. on sugar shipped from New York to Detroit and of 6 cents on sugar sent to Cleveland. The company was found guilty and fined $18,000 on each of six counts, while Pomeroy, who conducted the negotiations, was fined $1,000 on each of the six shipments to Detroit.

In its appeals the railway filed 101 assignments of error for the Detroit case and 80 for the Cleveland case, raising many new points against the validity of the law. Justice Day delivered the opinion of the court, which was unanimous. Taking up the contention that the law was void because Congress had no authority to impute to a corporation the commission of criminal offences or to subject it to a criminal prosecution by reason of the things charged, thereby in reality punishing the innocent stockholders and depriving them of property without due process of law; that the statute deprived the corporation of the presumption of innocence, which was part of due process in criminal prosecutions; that as there was no authority shown by the board of directors or the stockholders for the criminal acts of the agents of the company in contracting for and giving rebates they could not be charged against the company, Justice Day said that as no action of the board of directors or the stockholders could legalize a crime the argument practically amounted to saying that owing to the nature and character of the company's organization and the extent of its power and authority a corporation could not commit a crime of the nature charged in this case.

While he acknowledged that some of the earlier writers on common law held that a corporation could not commit a crime Justice Day said that the modern authorities universally held to the contrary, as he showed by quoting many decisions of the courts. It was also well established that a corporation might be held responsible for damages for acts of an agent done within the scope of his employment, but not wantonly, recklessly or against the express orders of his principal.

It was true, he said, that there were some crimes which in their nature could not be committed by corporations. But there was a large class of offences, of which rebating under the federal statutes was one, wherein the crime consisted in purposely doing the things prohibited by statute. In that class of crimes there was no good reason why corporations might not be held responsible and charged with the purpose and knowledge of their agents acting within the authority conferred upon them. If it were not so, many offences might go unpunished and acts be committed in violation of law, whereas in the present case the statute required all persons, corporate or private, to refrain from certain practices forbidden in the interest of public policy.

There was no valid objection in law and every reason in public policy, Justice Day continued, why the corporation which profited by the transaction and could only act through its agents and officers should be held punishable by fine.

Justice Day asserted that there was no question of the power of Congress to regulate interstate commerce, to prevent favoritism and to secure equal rights to all engaged in interstate trade.

Another case against the New York Central which the court below had quashed because the joint rate upon which the road had paid rebates to the Brooklyn Cooperage Company on shipments of barrel staves from Poplar Bluff, Iowa, had been filed by another road, was also decided against the road, the judgment of the lower court being reversed. Any road participating in a through rate and in a rebate from that rate is as guilty as the initial road.

The Santa Fe and Railway Regulation in Texas.

Officers of the Gulf, Colorado & Santa Fe gave testimony before Commissioner Harlan, of the Interstate Commerce Commission, at St. Louis on February 18, that illustrates finely the methods and results of railway regulation in Texas. The hearing was on the complaint of the Railroad Commission of Texas against advances in freight rates to Texas points.

C. F. W. Felt, Chief Engineer of the Gulf, Colorado & Santa Fe, said that in the five years since the last valuation of its property was made by the Texas Commission his road had made important improvements. Wooden trestles had been replaced by permanent structures; sags in the roadway had been filled; modern stations had been built at Dallas, Ft. Worth and other cities, and large shop buildings at Cleburne; and numerous interlocking signals had been installed. The original rails on the line were 60 lbs., while new rails of 65 lbs., 70 lbs. and 75 lbs. have been laid. He estimated the total cost of reproduction of the present lines at $35,189 per mile. Mr. Felt said the management of his road does not think it good policy for a railway to accept donations of land, and that it recently had refused to accept a donation and instead bought the preferred property at from $10 to $60 an acre.

J. H. Keefe, Assistant to the Second Vice-President and General Manager, testified that the road paid $123,000 in taxes in 1903, when it had 1,202 miles of track, and $377,000 in 1908, when it owned 1,518 miles, the increase per mile being 136 per cent. The amount spent in improvements from 1888 to 1907 had aggregated $13,335,000 and no dividend on stock had been paid since 1889. Referring to state legislation and orders of the Commission, Mr. Keefe said that in 1908 a new law increased the expense for telegraph operators $10,000; additional trains, required by a law which prevented full tonnage on the Beaumont division, alone caused an increase in expenses of $27,750; the order of the Railroad Commission made February 23, 1908, requiring passenger trains to run within 30 minutes of their schedules, compelled the running of special trains when regular trains were delayed, which had cost $30,345 during the year; additional interlocking signals required by another state law had cost $31,854. The gross earnings per mile of the Gulf, Colorado & Santa Fe were shown to be $7,300, and of the Atchison, Topeka & Santa Fe, $10,643; the Gulf lines' operating expenses were $6,300, and those of the Atchison $6,774; damage claims on the Gulf lines amounted to 3.4 cents a mile and on the Atchison 1 cent a mile. Owing to the extraordinary amount of railway litigation in Texas, the Gulf lines had spent during the previous year $79,000 for legal services out of gross earnings amounting to $11,000,000, while the Atchison proper, with earnings of $75,000,000, spent $233,000.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF DECEMBER, 1908.
(See also issues of February 5, 12 and 19.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$98,131	$48,936	$157,878	$24,564	$29,040	$3,392	$47,082	$5,345	$109,423	$48,455	.....	$4,760	$43,695	$12,417
Atlanta & Birmingham Air Line	237	61,008	21,897	86,458	10,987	7,001	2,097	33,848	2,161	56,094	30,364	.....	4,813	25,551	13,108
Bessemer & Lake Erie	201	298,680	21,342	325,203	34,094	92,416	8,619	121,227	24,457	280,813	44,390	.....	35,000	9,390	31,536
Central New England	294	175,754	25,386	214,661	29,090	17,584	1,587	78,131	2,442	128,834	85,827	.....	5,600	80,227	35,463
Central Vermont	411	191,575	62,730	275,903	29,812	59,782	6,865	144,995	7,590	249,044	26,859	$454	9,025	18,288	§16,394
Chicago, Cincinnati & Louisville	285	97,794	23,624	127,038	17,870	24,645	8,178	56,047	6,393	113,133	13,905	.....	3,250	10,655	33,432
Chicago Great Western	818	522,466	146,583	716,692	79,665	153,028	36,471	319,503	32,013	620,680	96,012	266	17,919	78,359	23,155
Chicago, Indiana & Southern—	329	235,208	20,048	263,200	837	49,395	8,599	98,592	7,600	165,023	98,177	3,852	12,542	89,487	65,973
Chicago, Peoria & St. Louis	255	109,469	25,576	142,146	18,648	29,409	6,208	60,465	4,730	119,460	22,686	.....	4,600	18,086	24,606
Cleveland, Akron & Columbus	210	112,242	34,830	162,014	12,568	28,846	1,894	57,070	2,850	103,228	58,786	.....	7,145	51,641	38,279
Cleveland, Lorain & Wheeling	194	161,723	18,858	193,390	23,034	55,125	5,799	99,062	5,986	189,006	4,384	.....	9,406	5,022‡	10,441
Cumberland Valley	162	144,896	43,351	198,382	9,289	16,669	4,265	74,269	8,693	113,185	85,197	405	3,713	81,889	2,262
Elgin, Joliet & Eastern	239	197,283	14	202,286	20,550	31,945	2,983	75,408	16,298	147,184	55,102	.....	9,500	45,602	7,730
Florida East Coast	584	128,032	87,354	248,766	35,247	33,161	5,548	85,445	7,384	166,785	81,981	.....	11,000	70,981	20,080
Fort Worth & Rio Grande	196	85,641	38,596	130,088	12,150	10,549	2,532	38,087	6,356	69,674	60,414	.....	1,681†	62,095	43,037
Gulf & Ship Island	307	135,098	34,849	181,262	33,821	23,793	1,174	51,817	7,748	118,353	62,909	.....	3,683	59,226	33,990
Houston East & West Texas	191	82,771	28,288	116,630	15,448	9,059	841	34,482	3,018	62,848	53,782	.....	4,230	49,552	6,041
International Ry. of Maine	233	79,328	29,599	116,254	25,283	20,536	4,307	56,035	3,823	109,985	6,270	.....	5,000	1,270	§266
Kanawha & Michigan	177	125,178	26,689	156,097	53,319	52,634	2,643	49,070	2,977	160,643	4,546*	28*	6,626	11,200‡	5,348
Mason City & Fort Dodge	386	121,686	36,731	166,471	15,324	23,323	1,740	76,602	877	117,866	48,605	524	6,000	43,129	§2,666
Midland Valley	324	69,926	23,879	98,441	21,750	28,329	1,800	31,669	4,746	88,294	10,147	.....	8,000	2,147	§29,069
Nevada & California	379	76,218	17,278	101,339	6,651	13,754	1,083	34,402	2,335	58,225	43,114	1,081*	6,000	36,033	§2,215
New Orleans & North Eastern	196	227,171	53,176	300,654	21,636	56,743	6,871	103,253	12,790	201,293	99,361	.....	8,500	90,861	34,970
New York, Philadelphia & Norfolk	112	186,418	31,473	233,928	19,857	48,083	3,313	92,069	10,828	174,150	59,778	.....	6,215	53,563	17,664
New York, Susquehanna & Western	151	140,767	47,641	213,826	19,049	23,351	1,450	76,457	5,068	125,375	88,451	2,113*	15,089	71,249	1,644
Pittsburgh & Lake Erie	191	794,017	96,084	925,054	125,779	116,693	12,109	242,412	22,150	519,143	405,911	357*	10,026	395,528	182,562
Quincy, Omaha & Kansas City	262	44,950	17,397	68,279	17,082	12,354	1,497	31,798	3,648	66,379	1,900	.....	2,960	1,060‡	3,975
St. Louis Merchants' Bridge Terminal	9	.....	5,022	111,214	16,345	4,270	230	45,929	3,362	70,136	41,078	.....	4,300	36,778	1,660
San Antonio & Aransas Pass	727	237,342	70,662	325,894	47,262	37,093	4,777	135,615	8,875	233,622	92,272	.....	8,500	83,772	29,735
Southern Indiana	237	71,969	14,037	87,992	9,526	17,316	1,400	28,485	5,082	61,809	26,183	.....	6,929	19,254	§36,198
Toledo, Peoria & Western	248	54,859	32,921	92,194	10,888	20,143	2,015	37,089	3,259	73,394	18,800	.....	4,000	14,800	2,715
Trinity & Brazos Valley	455	241,668	17,020	260,958	41,425	29,360	4,520	117,137	13,156	205,598	55,360	.....	6,299	49,061	186,673
Vicksburg, Shreveport & Pacific	171	80,256	53,633	143,478	31,330	22,493	3,062	40,449	4,584	101,918	41,560	.....	6,052	35,508	20,111
Virginia & South-Western	184	90,140	11,798	105,022	11,859	20,897	842	36,178	4,168	73,944	31,078	.....	5,640	25,438	22,270
Western Maryland	543	432,668	55,887	509,315	41,029	79,837	6,600	176,148	12,450	316,073	193,242	.....	16,500	176,742	24,158
Wisconsin, Minnesota & Pacific	271	38,465	14,893	57,702	7,249	7,275	283	23,108	496	38,411	19,291	4*	2,308	16,979	§3,636
SIX MONTHS OF FISCAL YEAR.															
Alabama & Vicksburg	143	$501,340	$241,584	$798,258	$125,333	$166,951	$19,408	$258,623	$29,499	$599,814	$198,444	.....	$23,920	$174,524	§$6,364
Atlanta & Birmingham Air Line	237	329,061	126,821	479,282	72,974	33,325	8,033	184,868	12,487	311,687	167,595	.....	28,880	138,715	29,886
Bessemer & Lake Erie	201	3,419,820	175,850	3,627,857	320,611	592,363	35,192	918,161	57,423	1,923,750	1,704,107	.....	55,000	1,649,107	§39,395
Central New England	294	1,004,962	183,792	1,259,680	223,411	124,002	10,033	417,468	16,442	791,356	468,324	.....	33,600	434,724	232,173
Central Vermont	411	1,122,243	575,335	1,832,684	283,317	304,101	46,925	820,685	40,838	1,495,866	336,818	5,915	54,150	288,583	§80,889
Chicago, Cincinnati & Louisville	285	504,175	156,990	694,534	176,965	151,023	46,319	292,515	35,809	702,631	8,097*	.....	19,500	27,597‡	§18,700
Chicago Great Western	818	3,013,143	1,050,047	4,380,866	624,007	750,120	218,955	1,828,140	180,614	3,601,836	779,030	3,921*	110,160	664,949	§60,378
Chicago, Indiana & Southern—	329	1,208,487	133,915	1,388,786	157,100	269,186	46,654	536,540	41,501	1,050,981	337,805	13,402	87,543	263,664	64,575
Chicago, Peoria & St. Louis	255	606,660	182,736	829,520	118,286	184,462	36,554	327,158	28,402	694,862	134,658	.....	27,600	107,058	19,368
Cleveland, Akron & Columbus	210	697,257	238,407	1,014,727	119,600	170,969	13,935	324,304	17,727	646,535	368,192	.....	40,222	327,970	33,186
Cleveland, Lorain & Wheeling	194	1,919,897	122,354	2,182,125	198,540	377,906	36,076	699,043	34,783	1,346,348	835,777	.....	56,438	779,339	§165,974
Cumberland Valley	162	909,234	307,561	1,277,535	120,304	111,763	23,098	394,194	34,145	683,504	594,031	3,626	22,278	575,379	§36,253
Elgin, Joliet & Eastern	239	1,194,301	268	1,237,613	134,718	201,348	15,137	391,357	48,054	790,614	446,999	.....	57,000	389,999	§84,362
Florida East Coast	584	565,315	337,724	1,058,146	258,659	239,402	28,811	479,054	51,371	1,057,297	849	.....	66,000	65,151‡	§54,405
Fort Worth & Rio Grande	196	389,673	184,565	606,837	79,718	59,851	15,526	201,347	30,815	387,257	219,580	.....	4,271	215,309	164,196
Gulf & Ship Island	307	693,926	188,992	939,953	197,915	149,449	8,388	310,633	43,449	709,834	230,119	.....	22,109	208,010	§50,103
Houston East & West Texas	191	440,278	145,358	619,289	102,248	48,291	7,415	185,074	18,569	361,597	257,692	.....	16,059	241,633	55,061
International Ry. of Maine	233	257,384	116,230	413,809	99,342	74,103	23,043	176,430	18,099	391,017	22,792	.....	30,000	7,208‡	20,048
Kanawha & Michigan	177	1,000,360	173,591	1,200,114	232,513	296,624	14,444	351,712	16,575	911,868	288,246	120*	39,959	248,167	183,830
Mason City & Fort Dodge	386	705,976	242,933	1,008,368	121,963	132,117	10,315	394,304	4,051	662,750	345,618	3,057	36,000	312,675	9,845
Midland Valley	324	350,656	133,052	512,105	125,319	113,143	10,312	165,007	25,932	439,713	72,392	.....	44,083	28,309	§106,803
Nevada & California	379	338,473	133,193	516,637	79,364	72,757	5,031	188,488	12,048	357,688	158,949	1,239*	40,067	117,643	§375,310
New Orleans & North Eastern	196	1,128,773	278,117	1,504,104	147,215	285,685	43,793	499,389	61,392	1,037,474	466,630	.....	44,000	422,630	7,060
New York, Philadelphia & Norfolk	112	1,123,325	202,520	1,421,822	111,807	251,267	18,895	514,426	67,855	964,251	457,571	.....	37,290	420,281	§94,776
New York, Susquehanna & Western	151	790,957	513,849	1,246,470	149,936	132,074	8,684	439,218	24,572	754,484	491,986	14,239*	59,482	418,265	21,464
Pittsburgh & Lake Erie	191	5,462,509	642,672	6,294,906	777,948	565,954	78,881	1,419,287	129,478	2,971,548	3,323,358	1,792*	97,526	3,224,040	§954,000
Quincy, Omaha & Kansas City	262	276,936	113,345	423,041	111,177	67,692	9,345	186,056	17,234	391,504	31,537	.....	15,210	16,327	20,614
St. Louis Merchants' Bridge Terminal	9	.....	23,981	674,147	106,719	29,328	1,315	266,711	20,603	424,676	249,471	.....	27,233	222,238	§81,718
San Antonio & Aransas Pass	727	1,563,116	441,619	2,108,721	280,905	217,321	25,294	747,380	52,300	1,323,200	785,521	.....	53,200	732,321	183,082
Southern Indiana	237	515,578	87,304	617,482	88,393	114,867	10,105	172,987	39,410	425,762	191,720	.....	41,571	150,149	§182,055
Toledo, Peoria & Western	248	341,246	209,443	580,168	92,137	109,001	12,517	208,234	19,586	441,475	138,693	.....	24,000	114,693	31,786
Trinity & Brazos Valley	455	1,016,505	89,897	1,123,010	192,544	159,426	26,172	502,519	66,993	947,654	175,356	.....	18,799	156,557	378,609
Vicksburg, Shreveport & Pacific	171	403,607	255,980	711,515	113,827	146,975	19,904	213,996	25,090	519,792	191,723	.....	36,453	155,271	42,610
Virginia & South-Western	184	535,801	77,550	634,971	70,529	104,338	5,343	183,133	22,442	385,785	249,186	.....	25,443	223,743	65,655
Western Maryland	543	2,489,136	462,970	3,094,266	340,459	449,682	43,514	963,971	70,142	1,867,768	1,226,498	.....	99,000	1,127,498	2,705
Wisconsin, Minnesota & Pacific	271	257,213	96,149	379,688	82,828	39,442	1,735	133,926	1,838	259,769	119,919	91	15,187	104,823	20,654

*Deficit. †Credit. ‡Loss. § Decrease.

Freight Car Balance and Performance.

Arthur Hale, Chairman of the Committee on Car Efficiency of the American Railway Association, in presenting statistical bulletin No. 40-A, giving comparative figures by groups, covering car balance and performance from April, 1907, to September, 1908, inclusive, says:

"This bulletin is a reprint of the statements attached to the committee's report at the November, 1908, meeting of the Association, with the addition of averages for June, July, August and September, 1908.

"The comparative table of adjusted averages which appears in our monthly bulletin, follows:

	Average miles per day.		Average ton-miles per car per day.		Average earnings per car per day.	
	Inc. surp. cars.	Exc. surp. cars.	Inc. surp. cars.	Exc. surp. cars.	Inc. surp. cars.	Exc. surp. cars.
December, 1907	21.9	23.9	289	316	$1.98	$2.17
January, 1908	20.8	24.9	277	325	1.81	2.17
February, 1908	19.7	23.8	271	328	1.82	2.20
March, 1908	21.2	25.5	290	348	1.95	2.34
April, 1908	19.6	24.5	258	324	1.83	2.29
May, 1908	19.3	24.8	254	329	1.72	2.22
June, 1908	19.6	24.7	276	347	1.88	2.37
July, 1908	20.0	24.8	275	342	1.84	2.26
August, 1908	20.8	25.1	292	354	1.98	2.40
Septmbr. 1908	22.0	25.2	320	367	2.24	2.57

"The statement as originally published contained a complete analysis of the performance for the 14 months ended May, 1908, from which we quote as follows, with additional comments on the performance for subsequent months:

"'The "per cent. of loaded mileage," quite graphically reflects the results brought about by the car surplus and the desire of the railways to rid themselves of foreign cars, the possession of which constituted a drain on their revenues. From the high figure of 72.9 per cent. reached in October, 1907, when the roads were enjoying an unprecedented traffic, the loaded mileage dropped to 70.2 per cent., 64.6 per cent. and 61.4 per cent. in November, December and January, respectively. February reports show a reaction to 66.5 per cent., which continued through March and April, while a further slight increase to 67.5 per cent. appears in May, 1908.'

"The increase continued throughout June was temporarily checked in July, when the figure was 67.3 per cent., but August and September show increases to 68.8 per cent. and 69.6 per cent. respectively.

"The reduced demand for cars also had its effect on the number of cars held out of service account of bad order. The October and November percentages of shop cars (5.55 per cent. and 5.27 per cent. respectively), gradually increased until in May, 1908, the figure reached 8.98 per cent. This figure continued to increase, reaching 10.18 per cent. in July, 1908, since which month the decrease has been steady although somewhat slight.

"The car balance percentages provide information showing the disposition of the freight car equipment of the country. In April, 1907, the railways reporting had on their lines only 54 per cent. of their own equipment, this being the lowest percentage of which we have any record since the year 1903, the earliest period for which there are any general car balance statistics. With the lessening demand for equipment, the tendency was toward a return of cars to their owners, and by August the per cent. of cars at home had increased to 62 per cent., the same average which appears in the report for the first six months of 1906. That the percentage was no higher during a month of light business than during a period which may be fairly considered as normal (notwithstanding the fact that the per diem rate was 50 cents during August, 1907, as against a rate of only 20 cents during the first half of 1906), indicates rather plainly that the common use of cars is being quite rapidly extended.

"With the fall revival in traffic, the per cent. of cars at home again shows a reduction, dropping to 60 per cent. in September and 58 per cent. in October, when the scattering of equipment was suddenly halted by the general business depression. In November, 1907, the number of cars returned to their owners exactly offset the number loaded off their home lines, while in December the returns exceeded the outward movement to such an extent as to increase the per cent. of cars at home to 64 per cent. From December this increase was continuous until April, 1908, when the figure reached 78 per cent., a total change of 20 points since November, 1907. The percentage for May was the same as for April. This percentage was maintained throughout June, but began to decrease with July, reaching 73 per cent. in September.

"Some of the group figures show still more remarkable changes. The roads in group 3 (Middle), which held but 49 per cent. of their cars during October, 1907, had this percentage increased to 85 per cent. in May, 1908. Group 9 (Southwestern) increased from 41 per cent. in November, 1907, to 66 per cent. in May, 1908, and group 2 (Eastern), from 56 per cent. in November to 75 per cent. in May. Group 1 (New England), while bringing about a net reduction in its total cars on line from 131 per cent. in November to 108 per cent. in May, shows an increase in its own cars at home from 58 per cent. to 78 per cent., plainly indicating a considerable cross movement of empty cars.

"With a few exceptions the subsequent changes by groups were similar to those in the general average. In group 1, the number of cars at home continued to increase and reached 81 per cent. in July and August, dropping to 76 per cent. in September."

Car Balance and Performance.

Month.	Roads reporting. No.	Roads reporting. Mileage operated.	No. revenue freight cars owned.	Per cent. ry.-owned cars on line. Home.	For-eign.	Total.	Per cent. cars in shop.	Av. cars on line per frt. eng. owned.	Average miles per car per day.	Per cent. of loaded mileage.	Average ton-miles. Per car.	Per loaded car.	Per car per day.	Average daily earnings. Per car owned.	Per ry.-owned car on line.	All cars on line.
April, 1907..	154	197,135	1,867,405	54	44	98	5.14	66	24.8	70.6	13.9	19.8	348	2.63	2.71	2.56
May, 1907..	155	210,733	1,935,740	55	43	98	5.24	65	25.6	69.9	13.7	19.8	354	2.66	2.75	2.60
June, 1907..	155	211,314	1,952,501	57	41	98	5.61	66	25.0	70.0	13.8	20.4	347	2.60	2.68	2.54
July, 1907..	154	215,781	1,976,871	60	38	98	5.77	65	23.1	69.3	13.9	20.0	331	2.50	2.56	2.42
Aug., 1907..	151	214,509	1,981,919	62	37	99	6.21	65	24.1	70.8	14.6	20.8	351	2.52	2.58	2.44
Sept., 1907..	158	220,273	2,088,051	60	38	98	6.02	64	24.0	71.8	14.6	20.5	354	2.58	2.64	2.50
Oct., 1907..	157	216,229	1,999,423	58	40	98	5.55	64	24.8	72.9	15.4	21.3	382	2.79	2.85	2.67
Nov., 1907..	168	217,385	2,006,892	58	41	99	5.27	64	24.2	70.2	14.6	20.9	354	2.52	2.56	2.43
Dec., 1907..	163	217,680	2,020,365	64	34	98	5.57	63	21.9	64.6	13.1	20.5	289	2.05	2.09	1.98
Jan.,* 1908..	151	217,794	2,072,851	71	26	97	5.63	63	20.8	61.4	12.8	21.4	277	1.85	1.90	1.81
Feb., 1908..	149	218,410	2,082,450	74	23	97	6.57	63	19.7	66.5	13.7	20.8	271	1.86	1.91	1.82
Mar., 1908..	153	218,516	2,084,689	74	23	97	7.29	63	21.2	66.5	13.6	20.6	290	1.99	2.05	1.95
Apr., 1908..	154	219,990	2,087,020	78	21	99	8.40	64	19.6	66.5	13.3	20.0	258	1.90	1.92	1.83
May, 1908..	161	220,745	2,090,612	78	20	98	8,98	63	19.3	67.5	13.1	19.7	254	1.77	1.81	1.72
June, 1908..	163	220,563	2,091,073	78	20	98	9.69	63	19.6	67.9	13.9	20.6	276	1.93	1.98	1.88
July, 1908..	159	220,086	2,084,787	77	21	98	10.18	64	20.0	67.3	13.8	20.6	275	1.89	1.92	1.84
Aug., 1908..	162	220,080	2,085,356	76	23	99	9.99	63	20.8	68.8	14.1	20.7	292	2.04	2.08	1.98
Sept., 1908..	159	221,307	2,081,303	73	26	99	9.69	64	22.0	69.6	14.7	21.1	320	2.31	2.35	2.24

*Total for months prior to January, 1908, includes three or four Mexican roads.

Hearing in Portland "Gateway" Case.

For the first time since the law gave the Interstate Commerce Commission power to require connecting railways to make through routes and joint rates, two great systems have locked horns before the Commission over that question. The Hill and Harriman lines are the parties. The Commission has issued some orders for through routes and joint rates, but these have heretofore been in proceedings brought by an electric interurban road or by some very small steam line to compel a large one to take through business from it. In this proceeding the Harriman lines are trying to make the Northern Pacific join in through passenger tickets through the Portland (Oregon) gateway to Seattle, Wash.

The hearing on the question was ordered on the Commis-

sion's own motion; but when Commissioner Prouty took testimony in Chicago last week representatives of the Union Pacific appeared to introduce evidence tending to show that the gateway ought to be opened.

E. L. Lomax, General Passenger Agent of the Union Pacific, said that thousands of travelers annually desire to go from the East and Middle West over his lines through Portland to Puget Sound. One reason is that they want to see the land that is being reclaimed by the government by irrigation. Many desire to go over the Union Pacific or the Denver & Rio Grande because of the scenery along these lines, and there are constant demands for through tickets via Portland. He said it had been the policy of the Union Pacific when it opened a gateway to open it to all lines alike; but the Northern Pacific is discriminating against the Harriman roads.

The testimony showed that in order to get passengers for Puget Sound points, the Harriman lines have been giving free tickets from Portland over the Northern Pacific. Passengers buying tickets at Omaha, Kansas City and other points on the Union Pacific are given orders for these side trip tickets, which are honored. These side trip tickets have been bought from the Northern Pacific at the regular rates, and by giving them free to passengers the U. P. has made the rate to Seattle and other Puget Sound points the same as it would be over the Hill lines (the Northern Pacific or Great Northern). The testimony of ticket agents at a number of points on the Harriman lines was introduced to show that the inconvenience of the change and re-ticketing at Portland caused many passengers, especially women, to prefer to buy their tickets over the Hill lines.

J. G. Woodworth, General Traffic Manager of the Northern Pacific, was the principal witness for the Hill lines. He argued that for each railway to insist on the long haul for freight or passengers moving to or from points in its territory, is the general practice, and departures from this rule are voluntary. When not forced by competition they are influenced by an allowance of excess or indemnifying provisions or by other considerations. He gave a number of illustrations. The Oregon Railroad & Navigation Company (Harriman) will not join with the Northern Pacific in equalizing via Spokane or other gateways, rates in effect between stations on its lines in Washington, Oregon or Idaho and points in eastern states. The Pennsylvania Railroad will not accept from the Wabash or the Lake Shore at Pittsburgh business from Chicago, St. Louis or other western common points destined to points on the Pennsylvania Railroad east of Pittsburgh. Usually the Union Pacific will not handle via junction points west of the Missouri river at equal rates passengers moving between points on its own line and points on or east of the Missouri river.

Mr. Woodworth said that new through trains over the Burlington from Kansas City, St. Louis and Chicago, in connection with the Northern Pacific and the Great Northern, to Puget Sound points will soon be put on, and probably be maintained not only during the Alaska-Yukon-Pacific exposition but permanently. He said the Hill lines would be able to give as satisfactory service as could be secured by any other route, and he contended that under these conditions they ought to be allowed to retain the advantage of the long haul to Puget Sound points. The Harriman lines were trying to get the benefit of a line from Portland to Seattle without incurring the expense of building it. F. C. Dillard, Counsel of the Harriman lines, intimated that this route might be satisfactory to the Hill lines, but that he did not think it would be as satisfactory to the passengers as would a through route over the Union Pacific. Mr. Woodworth contended that the scenery along the Northern Pacific was as good as that on any other route.

C. A. Cairns, General Passenger Agent of the Chicago & North Western, gave testimony indicating that his road could route passengers either via St. Paul over the Northern Pacific or via Omaha over the Union Pacific, but in many cases passengers preferred to go via Omaha, and he thought that the Portland gateway ought to be opened. P. S. Eustis, Passenger Traffic Manager of the Burlington, contended that the Burlington's route via Billings, in connection with the Northern Pacific, was a better one than any competing route, and that when representatives of his line got a passenger into the ticket office they could always sell him a ticket. He said he would prefer to have the Portland gateway closed tighter than it is now.

Several other witnesses were called for each side, including A. M. Cleland, General Passenger Agent of the Northern Pacific, and William McMurray, General Passenger Agent of the Oregon Railroad & Navigation Company. Commissioner Prouty announced that final argument in the proceeding would be heard on April 7. The Harriman lines were represented at the hearing by F. C. Dillard, Commerce Counsel; the Northern Pacific by C. W. Bunn, General Counsel, and the Chicago & North Western by S. A. Lynde, General Attorney.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

B. M. Waldron has been appointed Freight Claim Agent of the Cincinnati, Hamilton & Dayton, with office at Cincinnati, Ohio, succeeding F. J. Sweeney.

L. B. Houck, Superintendent of Traffic of the Chester, Perryville & Ste. Genevieve, has been elected First Vice-President and his former office has been abolished.

H. M. Bouck has been appointed Freight Claim Agent for steamship lines between New York and New Orleans and New York and Galveston of the Southern Pacific.

F. O. Waldo has been appointed Secretary of the Chicago, Kalamazoo & Saginaw, with office at Detroit, Mich., succeeding W. J. Kealey, deceased. J. E. Griffiths has been appointed Treasurer, with office at Detroit.

J. F. Dusenbury, whose resignation as Secretary and Treasurer of the Georgia, Florida & Alabama has previously been announced in these columns, has been elected President of J. R. Saunders & Co., Naval Stores Factors.

George F. Moore has been elected President of the Manufacturers Railway, with office at St. Louis, Mo., succeeding Adolphus Busch, resigned. He was born February 22, 1862, at Bloomington, Ind. In 1884, just after graduating from the Indiana State University, he began railway work as Assistant Cashier of the local freight office of the Louisville, New Albany & Chicago, now a part of the Chicago, Indianapolis & Louisville, at Chicago. In 1890 he was made Agent for the Louisville Southern, now a part of the Southern Railway. In 1894 he was appointed Freight Agent in charge of terminals of the Chicago & Alton, at Peoria, Ill., and in 1900 was made Chief Traveling Auditor of the same road. During the year 1900 he was also connected with the North Shore Despatch, a fast freight line operated from Chicago in the interest of the Michigan Central. In 1904 he was appointed Auditor of the Parral & Durango, and in 1906 he was made Auditor, Traffic Manager and Superintendent of the Boyne City, Gaylord & Alpena. In 1907 he was appointed General Manager of the St. Joseph Valley. In 1908 he was appointed an Examiner of the Interstate Commerce Commission at Washington, D. C., which position he held until his recent appointment.

George F. Moore.

Hunter H. Laughton, whose appointment as Auditor of the Southern Railway was recently announced in these columns, was born in Richmond, Va., and after a public school educa-

tion began railway work in 1885 as messenger boy on the Richmond & Danville, now part of the Southern Railway. By 1887 he had become clerk in the freight auditor's office, and two years later was transferred as clerk to the General Auditor's office. On April 1, 1894, he was made clerk in the disbursing office, and on January 1, 1901, was made auditor of disbursements, which position he held until his recent appointment.

Operating Officers.

C. H. Stengel has been appointed Superintendent of Coal Terminals of the Virginia Railway, at Sewalls Point, Va.

C. M. Bryant, Acting Trainmaster of the Missouri, Kansas & Texas, at Denison, Tex., has been appointed Superintendent at Smithville.

George R. Raine, Chief Inspector of the Southern Demurrage & Storage Bureau, New Orleans, La., has been appointed General Manager, succeeding Seeley Dunn, resigned to go into another business.

W. Rudd, Chief Train Despatcher of the Missouri, Kansas & Texas of Texas, at Smithville, Tex., has been appointed Trainmaster at Smithville, succeeding W. W. Hoffman, resigned to engage in other service.

George W. Clark, General Yardmaster of the Central New England, has been appointed Assistant Superintendent, with office at Poughkeepsie, N. Y., succeeding F. W. Danks, resigned to take a position with another road.

W. J. Witte, Assistant Superintendent of Dining Car Service of the Chicago & Alton, has been appointed Superintendent of Dining Car Service, succeeding Fred McIntosh, resigned, to accept the management of a hotel at Dwight, Ill. Effective March 1.

J. A. Boyers has been appointed Assistant Superintendent of the Nashville, Chattanooga & St. Louis at Nashville, Tenn., succeeding J. T. C. Davis, resigned. E. A. Hibbett has been appointed Trainmaster of the Chattanooga and Nashville divisions; G. J. Hearn has been appointed Chief Despatcher of the Chattanooga division, and W. H. Smith has been appointed Chief Despatcher of the Nashville division.

J. C. Vining, General Superintendent of the Colorado Midland, has resigned and his office has been abolished. F. B. Miller, Trainmaster at Cardiff, Colo., has been appointed Superintendent, with office at Colorado City, and will assume the duties heretofore assigned to the General Superintendent. F. D. Weidenhamer, Trainmaster at Colorado City, succeeds Mr. Miller and his former office has been abolished.

F. H. Dever, Superintendent of the Houston Belt & Terminal, has been appointed Inspector of Passenger Service of the Gulf, Colorado & Santa Fe, with office at Galveston, Tex., and the position of Superintendent of the Houston Belt & Terminal Railway has been abolished. In all likelihood, J. J. Flynn, Superintendent of the Trinity & Brazos Valley, will be made General Manager of the Houston company some time in March, and will assume charge of the construction work contemplated for Houston. This is a new position.

J. E. Hurley, General Manager of the Atchison, Topeka & Santa Fe, has been appointed General Manager, Eastern Lines, which includes all divisions east of Newton, Kan., and Wellington, with office at Topeka. C. W. Kouns, Assistant to the Second Vice-President, has been appointed General Manager, Western Lines, which includes all divisions west of Newton and Wellington and east of Silver City, N. Mex., and Isleta, with office at Amarillo, Tex. This division of territory was made necessary by heavy increases in traffic. The appointments are effective March 31.

Traffic Officers.

C. J. Payton, Commercial Agent of the St. Louis, Brownsville & Mexico, at Corpus Christi, Tex., has resigned.

C. S. Riley, Agent for the Gulf, Colorado & Santa Fe, at Ardmore, Okla., has been appointed Agent of the Houston Belt & Terminal.

S. C. Greusel has been appointed General Freight and Passenger Agent of the Chicago, Kalamazoo & Saginaw, with office at Kalamazoo, Mich.

S. H. Johnson, Assistant General Freight Agent of the Chicago, Rock Island & Pacific, has been appointed Assistant Freight Traffic Manager, with office at Chicago.

J. R. Peachy has been appointed Traffic Manager of the Chester, Perryville & Ste. Genevieve, with office at St. Louis, Mo., succeeding L. B. Houck, promoted. The office of Superintendent of Traffic, which was formerly held by Mr. Houck, is abolished.

Engineering and Rolling Stock Officers.

S. S. Riegel has been appointed Mechanical Engineer of the Delaware, Lackawanna & Western, at Scranton, Pa., succeeding J. A. Mellon, resigned.

W. H. Potter has been appointed Superintendent of Telegraph of the Southern Railway, with office at Washington, D. C., succeeding C. P. Adams, deceased.

James M. Reid, Chief Engineer Construction of the National Lines of Mexico, has been appointed Chief Engineer of the National Railways of Mexico, with office at Colonia station, Mexico City.

B. W. Benedict has been appointed Bonus Supervisor of the Atchison, Topeka & Santa Fe, at Topeka, Kan., and will have territorial charge of bonus work on the Eastern Grand division and functional supervision over standardization of schedules.

The officers of the Maintenance of Way and Bridges and Buildings department of the Rutland, formerly reporting to George L. Moore, whose resignation as Chief Engineer we have previously announced, will hereafter report to M. H. Elkin, Assistant Engineer, at Rutland, Vt.

Edgar B. Thompson, whose appointment as Superintendent of Motive Power and Machinery of the Chicago, St. Paul, Minneapolis & Omaha has been announced in these columns, was born March 18, 1859, at Woburn, Mass. After taking a special course in the Massachusetts Institute of Technology he began railway work on May 18, 1882, with the Chicago & North Western, at Chicago. On February 26, 1885, he was made chief draftsman, and on February 2, 1895, was appointed Mechanical Engineer. On March 12, 1897, he was appointed Mechanical Engineer of the Northern Pacific. From March to August, 1899, he had charge of some special work in the car department of the Chicago & North Western. On August 5, 1899, he again assumed the duties of Mechanical Engineer of the Chicago & North Western, and on January 1, 1903, he was made Master Mechanic at Mason City, Iowa. On June 1, 1903, he was appointed Master Mechanic at Winona, Minn., and on July 1, 1906, was made Assistant Superintendent of Motive Power and Machinery, which position he held until his recent appointment.

E. B. Thompson.

OBITUARY.

Thomas E. Swann, formerly Assistant General Passenger and Ticket Agent of the Denver & Rio Grande, died at Pueblo, Colo., on February 16. He was born December 21, 1862.

Andrew W. Conners, formerly Trainmaster of the Chicago & North Western, and for 50 years continuously in the service of that road, died at Chicago on February 16 from pneumonia.

Railroad Construction.

New Incorporations, Surveys, Etc.

ALLENTOWN & READING TRACTION.—Press reports say that this company is making surveys for a cut-off from the present line at Lyons, Pa., northeast via Bowers, Topton, Hancock, Shamrock and Alburtis to the main line at either Trexlertown or East Texas, about 15 miles.

ALTOONA, HOLLIDAYSBURG & BEDFORD SPRINGS (ELECTRIC).—An officer writes that work will be started this year on its proposed electric line from Altoona, Pa., via Everett to Bedford Springs. All the right of way is about secured. W. W. Rudisill, President; F. Bendheim, Treasurer, and J. F. Kaufmann, Secretary, all of Altoona. (Jan. 29, p. 235.)

ASHERTON & GULF.—The Nueces Valley, Rio Grande & Mexico was organized to build a line from Eagle Pass, Tex., east to Aransas Pass, about 300 miles. Work is now under way by the J. F. Burns Construction Co., of Devine, Tex., on the 32-mile section from Artesia, Tex., west to a point on the International & Great Northern at Asherton, Dimmet county. An officer writes that the name of the company has been changed to the Asherton & Gulf, with headquarters at Asherton. Grading finished on 20 miles and tracklaying to be begun March 1. A. Richardson, President, and R. H. Gresham, Chief Engineer, Artesia. (Jan. 29, p. 236.)

ATLANTIC, QUEBEC & WESTERN.—An officer writes that the work carried out by this company last year on the extension building from Port Daniel, Que., northeast toward Gaspe included grading 26 miles, 20 of which was between Port Daniel and Grand Pabos, and six miles on the Gaspe end. From Port Daniel to Pabos nearly all of the grading was heavy rock work. At Port Daniel an 850-ft. tunnel was finished, and last summer foundations for nine steel bridges were put in between Port Daniel and Pabos; the steel superstructures are now being erected. The heaviest foundations put in were at North river, Port Daniel, where there will be three spans of 100 ft. and one span of 200 ft. over the river. Between Port Daniel and Grand Pabos there will be one-half mile of steel bridges, one-half mile of pine trestles and one mile and a half of temporary trestles. All the rock work through to Gaspe has been finished. From 1,500 to 1,800 men were at work during the summer on the lines. From Pabos to Gaspe, 62 miles, work is now under way by the New Canadian Co., Ltd., New Carlisle, Que. (Dec. 18, p. 1608.)

DENVER, COLORADO SPRINGS & PUEBLO INTERURBAN.—Incorporated in Colorado, with $4,500,000 capital and office at Denver. An officer writes that surveys are being made for a projected line from Denver south via Colorado Springs to Pueblo, 119 miles. The section from Denver south to Colorado Springs, 74 miles, is to be built first. L. M. Pfeiffer, A. E. Van Deusen, Denver; W. T. Brinford, Salt Lake City; C. Ledener and F. C. Lewis, of Chicago, are interested.

EVANSVILLE & SOUTHERN INDIANA TRACTION.—According to press reports this company will extend its line from Patoka, Ind., north to Hazleton, eight miles, this year, and may build a further extension next year to Vincennes and eventually to Terre Haute, 75 miles.

GAINESVILLE, WHITESBORO & SHERMAN INTERURBAN.—An officer writes that work has been discontinued on this proposed line from Gainesville, Tex., east to Sherman, 39 miles. About 12 miles of grading has been completed from Gainesville. Track laying has been indefinitely postponed.

LOOP & LOOKOUT.—See Sewell Valley.

MANITOBA & GREAT NORTHERN.—A bill is before the Manitoba Legislature to incorporate this company with $2,500,000 capital. Permission is asked to build railway lines from Winnipeg, Man., west to Brandon, thence west via Elkhorn, Man., to a point at the western boundary of Saskatchewan; from Morden north via Rathwell to the Winnipeg-Brandon line. The company also asks permission to buy lines from Gretna at the United States boundary north to Portage la Prairie, and from Morden south to the United States boundary. The incorporators include L. W. Hill, J. Fisher, C. P. Wilson, J. F. Fisher and R. I. Farrington. The general offices are to be in Winnipeg. About two years ago Chairman James J. Hill, of the Great Northern, was quoted as saying that that company would build an additional line across western Canada. It is thought that the present company has been incorporated to carry out that project.

MARIETTA & LAKE.—Incorporated in Ohio, with $100,000 capital and headquarters at Cambridge. The company proposes to build a line from Lore City, Ohio, east thence north through Guernsey, Belmont and Harrison counties to Freeport, about 30 miles. C. S. Sheppard, S. R. Heade, E. D. Shively, C. Cosgrove and D. R. Wallace are incorporators.

MEXICAN RAILWAY.—In the betterment work on this line during the past year, some 4,000 tons of 85-lb. British section rails were laid. A sample section of 10 miles of line was laid with 85-lb. rail placed on creosoted American pine ties, with the object of making a comparison of the life of wood and steel ties. With the exception of this 10-mile section, all of the line is now laid with steel ties. A lot of 4,000 tons of 85-lb. rail is now on order for delivery in March. All of the bridges are being strengthened with new girders, designed to carry an axle load of 50,000 lbs., and this work should be completed by the end of this year. The Missouri Valley Bridge Co. are contractors for the steel work. An engineering party is at present in the field running lines on the Plateau, reducing the grades from 1½ per cent. to 1 per cent., and the curves to a maximum of one degree. It is not at present decided when the construction work on this section will begin.

NORFOLK & WESTERN.—An officer writes that this company has finished the Tug Fork branch extension for 3.84 miles above Pageton, W. Va., to Anawalt-Operation No. 12 U. S. Coal & Coke Co.

The Spice Creek branch in Roderfield, W. Va., has been built for 4.54 miles to the Premier Pocahontas Collieries operation, and is now in operation.

The Poplar Creek branch near Cedar, W. Va., has been built and is now in operation for 2.07 miles, to the Majestic Collieries operation.

Work is now in progress double-tracking the line between Huger, W. Va., and Welch. This improvement includes a double-track tunnel at Welch. It is expected to have this section of the double-track work finished about July 1.

On the Big Stony Railway track has been laid to the West Virginia state line, 16.70 miles from the junction of the Big Stony Railway with the N. & W., near Ripplemead, W. Va.

The Interior & West Virginia is under construction through Monroe county, W. Va., from the terminus of the Big Stony Railway at the Virginia state line, to a connection with the Virginia & Potts Creek Railroad, 17.55 miles. The roadbed and bridging are about 90 per cent. finished, and it is expected to have the line in operation by July.

The Virginia & Potts Creek has grading about 98 per cent. finished on the 4.2 miles under construction from the end of the Interior & West Virginia Railroad to Paint Creek, Va. These lines are being built to develop extensive iron ore properties in Potts Creek valley.

NUECES VALLEY, RIO GRANDE & MEXICO.—See Asherton & Gulf.

PALESTINE & DALLAS INTERURBAN.—An officer writes that contracts are to be let in May for building this line, projected from Palestine, Tex., northwest via Corsicana, Waxahachie to Dallas, 110 miles, with a branch from Waxahachie east to Ennis, 10 miles. There will be one small bridge over the Trinity river. J. V. Watkins, President, and G. A. Duren, Chief Engineer, Corsicana. (See Texas Roads, Jan. 22, p. 187.)

RANGELEY LAKES & MEGANTIC.—Incorporation has been asked for by this company in Maine to build 30 miles of railway from Oquossoc, Me., north to the Quebec boundary. The incorporators include L. Tuttle, H. B. Cleaves, E. P. Ricker, S. M. Carter, F. A. Wilson, M. McDonald and J. W. Symonds.

ST. LOUIS, BROWNSVILLE & MEXICO.—An officer writes that the Buckeye spur line from Buckeye, Tex., has been extended and is now nine miles long. The line may eventually be further extended for a branch to have a total length of 20 miles. Surveys made for an extension from Donna, Tex., to Sugar Mills, two miles. (Dec. 18, p. 1609.)

San Diego, El Paso & St. Louis.—An officer writes that this company was organized to build a line from El Paso, Tex., northeast through the southeastern corner of New Mexico, and through Texas to the Texas-Oklahoma boundary on the Red river, about 500 miles. The company has been granted a charter in Texas, with a capital of $100,000, to build the first 100 miles northeast from El Paso to the New Mexico line. Application will shortly be made for a charter in New Mexico, with a capital of $4,000,000, to cover about 200 miles to cross that territory. Surveys are now being made locating this part of the line. Rights of way and sites for terminals have been secured for almost the entire line. There will be bridges at Pecos, Yellowhouse and Peace rivers. L. P. Atwood, Chief Engineer, El Paso.

Seattle-Everett Traction.—This company and the Everett Railway, Light & Water Co. have given a contract to the Stone & Webster Engineering Corporation, Boston, Mass., for building an interurban railway from Halls Lake, Wash., to Everett, a distance of 13 miles. A nine-mile section of interurban railway between Seattle and Halls Lake is built, and this, together with the new section, will form a through interurban connection between Seattle and Everett. The Seattle Electric Co. will provide the connecting line between the interurban at the city limits and its own system.

The road will be built entirely on private right-of-way. Catenary overhead construction will be used and current will be supplied from a substation to be located half-way between the Freemont substation of the Seattle Electric Co., in Seattle, and the power station of the Everett Railway, Light & Water Co., in Everett. The Freemont substation receives current from either the Puyallup water power plant or the Georgetown turbine station. From this substation the current will be carried at 13,000 volts to the new substation for the interurban. The present arrangements provide for improvements in the present line from Seattle to Halls Lake as well as all the work involved on the new section. (Oct. 2, p. 1076.)

Sewell Valley.—An officer writes that contract has been given to the Morasco-Pasqua Lichie Co. for building two miles of the line now under construction from Meadow Creek, W. Va., into the mountains to coal and timber lands, 21 miles. The company is building with its own forces the remaining 19 miles. Grading is finished for about two-fifths of the way to the mouth of Sewell creek on Meadow river, at which point it joins the survey for the Loop & Lookout Railroad to be built along the Meadow river, about 25 miles, on which some grading has been done. (Nov. 13, p. 1374.)

Southern Utah.—An officer writes that this company, which is building a line from Miller Creek coal mines northeast to Price, Utah, about 20 miles, has grading finished on about six miles and expects to begin track laying April 1. The Ely Construction Co., of Springville, are the contractors. J. F. Williamson, Price. (Dec. 11, p. 1561.)

Spokane & Inland Empire (Electric).—An officer writes that work is to be started this month on the tunnel in the business district of Spokane, Wash., through which this line is to run. (Dec. 11, p. 1561.)

Stamford & Northwestern.—We are told that this company, which is building a line from Stamford, Tex., westerly to Dickens, 75 miles, expects to have all the grading finished and several miles of track laid by July 1. P. M. Johnston, Son & Allhands, of St. Elmo, Ill., have contracts for grading, buildings, bridges, etc. Sub-contract is let to J. L. McSpadden for the first five miles out of Stamford. About 350 teams are now at work. Track laying is to be carried out by the company's forces. P. J. Burns, Chief Engineer, Stamford. (Jan. 29, p. 236.)

Twin City & Lake Superior (Electric).—An officer writes that additional contracts are to be let about April 1 by this company building a double-track third-rail line from Minneapolis, Minn., northeast via St. Paul, Minn., and Superior, Wis., to Duluth, Minn., 130 miles. Contracts let as follows: From the lower St. Croix river to upper St. Croix, 33 miles, to Westerdahl & Carlson, and from upper St. Croix to Superior, Wis., 60 miles, to Smith & Jones. Track laid from Minneapolis to Coon Lake, 25 miles. There will be two large bridges. J. H. Thomas, Chief Engineer, 440 Railway building, Minneapolis. (June 5, p. 47.)

Railroad Financial News.

Atlanta, Birmingham & Atlantic.—The Old Colony Trust Co., Boston, Mass., has brought suit to foreclose the mortgage of 1906, under which $14,443,000 bonds are outstanding. Construction claims amounting to $771,300 have also been filed, the contractors asserting that their claims are a first lien on the property of the road.

Baltimore & Ohio.—It is understood that the directors, in company with J. P. Morgan & Co., New York, are considering the purchase of control of the Cincinnati, Hamilton & Dayton.

Central Trunk.—See Jamestown, Franklin & Clearfield.

Chicago & Milwaukee (Electric).—Suit has been brought by the trustee of the Illinois division mortgage of 1902, under which $4,000,000 bonds are outstanding, to foreclose. The interest coupons due January, 1908, and January, 1909, are in default.

Chicago & North Western.—Outstanding Ottumwa, Cedar Falls & St. Paul first mortgage 5 per cent. bonds, amounting to $1,600,000, are to be paid at maturity on March 1.

Cincinnati, Hamilton & Dayton.—See Baltimore & Ohio.

Denver & Rio Grande.—Blair & Co., William Salomon & Co. and Wm. A. Read & Co. have bought an additional $5,000,000 first and refunding mortgage 5 per cent. bonds of 1908-1955, and have sold the bonds at a subscription price of 93. This makes $22,500,000 of these bonds outstanding. The proceeds of the sale of the additional $5,000,000 bonds are to be used to buy equipment and to pay for improvements.

Duluth, Rainy Lake & Winnipeg.—D. R. Hanna, Vice-President of the Canadian Northern; L. W. Mitchell, D. J. Morton and W. D. Bailey have been elected new directors, and W. H. Cook has been re-elected a director.

Franklin & Clearfield.—See Jamestown, Franklin & Clearfield.

Hudson & Manhattan.—The Guaranty Trust Co., New York, has sold at a price to yield 6 per cent., $920,000 5 per cent. car trust certificates, dated March 1, 1909, maturing $46,000 semi-annually. The certificates are secured by 90 cars, costing $1,143,180, of which $223,180 was paid in cach.

Hudson Companies.—Harvey Fisk & Sons, New York, are offering at par $1,500,000 6 per cent. secured convertible notes due 1911. The notes are convertible into Hudson & Manhattan first mortgage 4½ per cent. bonds, the bonds to be taken at 85 per cent. (Oct. 16, p. 1178.)

Jackson Coal Road.—See Jamestown, Franklin & Clearfield.

Jamestown & Franklin.—See Jamestown, Franklin & Clearfield.

Jamestown, Franklin & Clearfield.—Stockholders of the Franklin & Clearfield, the Jamestown & Franklin, the Central Trunk and the Jackson Coal Road are to meet to-day to vote on consolidating the four roads under the name of the Jamestown, Franklin & Clearfield. The roads are controlled by the Lake Shore & Michigan Southern.

Kansas City, Mexico & Orient.—The United States & Mexican Trust Co., Kansas City, and W. Franklin Burnham, Boston, Mass., are offering $1,000,000 Kansas City, Mexico & Orient first mortgage 4 per cent. bonds of 1901-1951 at par, each bond carrying with it a bonus of 40 per cent. of 4 per cent. non-cumulative preferred and 40 per cent. common stock.

Lake Shore & Michigan Southern.—See Jamestown, Franklin & Clearfield.

New London Northern.—This company, whose property is leased to the Central Vermont, has applied to the Connecticut legislature for authority to issue $1,500,000 bonds for refunding and improvements and additions.

New Orleans Terminal.—Potter, Choate & Prentice, New York, are offering $3,000,000 New Orleans Terminal 5 per cent. notes of 1909-1911 at 100½, yielding about 4¾. The authorized issue of these notes is $3,500,000, of which $2,500,000

is issued to retire a like amount of 6 per cent. notes maturing April 10, 1909, and the proceeds of $500,000 is to be used for additional improvements, the remaining $500,000 being held in the treasury. Both the present issue and the issue to be retired are guaranteed principal and interest by the Southern Railway and the St. Louis & San Francisco. The earlier issue was secured by a deposit of $4,000,000 New Orleans Terminal first mortgage 4 per cent. bonds, the bonds themselves being guaranteed by the Southern and the 'Frisco, and the present issue of notes is secured by a deposit of $5,000,000 bonds. The notes that are to be retired were offered in March, 1908, at 98¼, by the same bankers that are now offering the new notes, and since they were 6 per cent. notes, at the offering price they yielded about 7¾ per cent.

SOUTHERN PACIFIC.—Stockholders are to vote on April 7 on the question of authorizing an increase of the common stock by $100,000, of which as much as necessary shall be set aside to provide for an issue of 4 per cent. 20-year bonds, convertible until June 1, 1919, at the option of the holder, into common stock, at the rate of 130 per share. The holders of both common and preferred stock are to be given the privilege of subscribing on or before April 20 for $82,000,000 of these convertible bonds. The offering price is 96 and stockholders may subscribe to the extent of 30 per cent. of their holdings. After deducting the amount of bonds allottable to the Oregon Short Line, there are $44,500,000 bonds left to offer to other stockholders, this amount having been underwritten by Kuhn, Loeb & Co., New York. Advances to proprietary companies for construction and additions and other expenditures for such purposes up to June 30, 1908, amounted to $103,332,545. Details of these expenditures are given in the annual report as follows:

Construction of new lines not yet financed by the companies directly owning them	$44,310,194
Purchase of new lines not yet financed and other properties	11,309,291
Advances for account of electric lines	5,526,914
Rolling stock	18,424,447
Steamships and other floating equipment	7,900,952
Real estate and other properties, principally terminals in San Francisco and other localities	15,860,787
Total	$103,332,585
Cost of stocks of Pacific Fruit Express & Los Angeles Ry.; stocks and bonds of Associated Oil Co., Pacific Electric Ry., Northwestern R.R., and of other companies, as shown in last annual report, which are a free asset of the company	38,606,586
Total	$141,939,171
Advances and expenditures from July 1, 1908, to December 31, 1908, for similar accounts amounted to	12,439,733
Total, December 31, 1908	$154,378,903
As a result the company now requires:	
For the discharge of outstanding loans	35,838,945
For additions and betterments heretofore authorized, principally for the reduction of grades, improvement in alinement and additional main track and sidings	3,756,320
For new equipment under contract	7,467,658
For construction of new lines heretofore authorized and already under way, as stated in the last annual report	19,796,045
Total	$66,858,968

To provide the funds necessary to meet these present requirements and for future betterments and additions to the property, and for other corporate purposes, an issue of such bonds to the amount of about $82,000,000 at this time is deemed advisable by the directors.

SOUTHERN RAILWAY.—It is said that J. P. Morgan & Co. have bought sufficient general mortgage and development 4 per cent. bonds of the Southern Railway to provide the Southern with money to redeem the $16,000,000 outstanding 5 per cent. notes that mature April 1.

TEXAS & PACIFIC.—The interest due March 1 on $24,660,975 5 per cent. second income bonds is to be passed, since no surplus from operations is properly available therefor. Five per cent. was paid from 1902 to 1907, inclusive, and 3½ per cent. was paid in 1908.

WESTERN MARYLAND.—A new issue of $2,000,000 5 per cent. receiver's certificates dated March 1, 1909, and payable on or before March 1, 1911, has been authorized by the United States Circuit court. Of these certificates, $866,371 are to be issued to pay for new rolling stock and $1,133,629 are to be issued to refund receiver's certificates issued under order of June 5, 1908.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Woodward Iron Co., Woodward, Alb., has ordered one locomotive from the Baldwin Locomotive Works.

The New York, Chicago & St. Louis inquiry for 20 locomotives reported in the *Railroad Age Gazette* of February 12, includes 10 ten-wheel freight and 5 six-wheel switching locomotives.

The Chicago, Rock Island & Pacific, as reported in the *Railroad Age Gazette* of December 25, has ordered 33 simple Pacific locomotives from the American Locomotive Co. for delivery beginning March 1.

General Dimensions.

Weight on drivers	149,000 lbs.
Weight, total	220,000 lbs.
Cylinders	23 in. x 28 in.
Diameter of drivers	73 in.
Boiler, type	Extended wagon top
" working steam pressure	185 lbs.
" diameter at smallest ring	68⅝ in.
Heating surface, tubes (approximate)	3,375 sq. ft.
" " firebox "	180 "
" " total "	3,555 "
Tubes, number	About 328
" diameter	2 in.
" length	19 ft. 9 in.
Firebox, length	108 in.
" width	60 in.
" depth	Front, 80½ in; back, 68½ in.
Grate area	45 sq. ft.
Tender, style	Water bottom
" truck	Equalized pedestal
" water capacity	7,500 gals.
" coal capacity	13 tons

Special Equipment.

Bell ringers	Gollmar
Blow-off valves	Crane
Boiler covering	Franklin
Couplers	Latrobe
Headlights	Pyle-National
Injectors	Simplex
Lubricators	Nathan
Metallic Packing	United States
Safety valves	Ashton
Sanding device	Leach
Springs	Railway Steel-Spring Co.
Steam gages	Ashton
Tender brake-beams	Creco
Valves	Richardson

CAR BUILDING.

The Virginia & Southwestern has given an order to the Western Steel Car & Foundry Co. for repairing 10 forty-ton gondola cars.

The Isthmian Canal Commission will receive bids until March 8, 1909, for 20, twelve-ton, 3-ft. gage flat cars. (Circular No. 495.)

The Intercolonial, reported in the *Railroad Age Gazette* of February 19 as having ordered five baggage cars from Canadian builders, has also ordered 10 colonist cars; 3 from the Silliker Car Co.; 3 from the Crossen Car Manufacturing Co., and 4 from Rhodes, Curry & Co.

IRON AND STEEL.

The Delaware, Lackawanna & Western is said to be in the market for 4,000 tons of rails.

The New Orleans & Northeastern has ordered 1,400 tons of rails from the Illinois Steel Co.

The El Paso & Southwestern has ordered 6,200 tons of rails from the Colorado Fuel & Iron Co.

The Long Island is in the market for 400 tons of structural steel for use on the Dutch Kills bridge.

General Conditions in Steel.—The announcement, last week, of an open market on steel did not specially mention rails, and the present indications are that the independent manufacturers and the United States Steel Corporation have this yet to settle. Chairman Gary is quoted as saying that: "The price of steel rails will not be reduced by the United States Steel Corporation at present." The price of $28 per ton has been maintained for the past eight years. Market reports

indicate that over 200,000 tons of rails will be placed if the price be cut to $25, which places a decided temptation before the independents.

SIGNALING.

Absolute Block System on the Northern Pacific.

The Northern Pacific on February 8 adopted the "A B C" block signal rules on the lines between Billings, Mont., and Livingston, 115 miles. The company is planning to adopt the same signal rules on the Washington Central branch, extending 142 miles northwest from Spokane, and on the Palouse and Lewiston branches, which extend south from Spokane, 146 miles; and in connection with the change a telephone line will be put up and all communications will be made by telephone. As all of the trains on these branches do local business, many of the less important stations will be equipped with telephones arranged for use by the conductors of the trains, and no station operator will be required.

Oil Burning Locomotives on the Mexican Railway.

Two new Fairlie mountain locomotives have just been received for use on the 4 per cent. mountain grades of this line. These locomotives carry 125 tons on the drivers, and are said to be about the heaviest locomotives of this class ever built. This company now has 15 locomotives burning oil and about 40 additional ones will be equipped for this fuel by the end of June, and all of the motive power will be thus equipped by the end of the year. Large oil storage tanks are being built at Vera Cruz, Orizaba, Esperanza and Mexico.

South Manchurian Trains.

Consul Roger S. Greene, of Dalny, reports that the South Manchuria Railway on October 27 made a trial run of the new American first-class cars which are to be used for its express trains connecting with the Chinese Eastern at Changchun. The train, consisting of a first-class day coach, two sleepers, one dining car, and one baggage car, took a party of invited guests, leading Japanese officials, foreign consuls, foreign and Japanese merchants and newspaper men, to the station of Chinchou, a run of about one and one-fourth hours from Dalny. After an hour's stay the return trip was made at the speed at which the express trains are to be run, an average of about 30 miles an hour, reaching a maximum of about 45 miles per hour, so that the guests were able to observe the behavior of the cars under actual service conditions.

The company officials were greatly pleased with the finish, equipment and smooth running qualities of the cars. The sleepers, diners and first-class coaches are all standard cars, and fitted with all improvements. They are heated by steam and lighted by electricity. The sleepers are of the usual American type with two drawing rooms at one end, each having three berths and a private lavatory.

The express trains on which these cars will be used are to be run twice a week, leaving Dalny on Mondays and Fridays, thus connecting with only two of the Trans-Siberian express trains, the International Sleeping Car Co.'s train and the St. Petersburg express. The South Manchuria Railway's liner Kobe Maru will continue to run weekly between Dalny and Shanghai to connect with the International express. It will leave Dalny Mondays at 2 p.m. and arrive at Shanghai Wednesdays, while on the return trip it will leave Shanghai Friday morning and reach Dalny early Sunday morning.

The first express train left Dalny on October 30 at 8 a.m. The journey from Dalny to Changchun, which has hitherto taken 25 hours, will now be made in 21 hours, thus bringing the passengers to Changchun at 5 a.m., an arrangement made unavoidable by the time-table of the Russian trains with which connections must be made. The southbound train will leave Changchun at 8.40 p.m. on Tuesdays and Saturdays, and will arrive at Dalny at 6.15 the following evening.

Supply Trade News.

The Wells Light Manufacturing Co. has moved its general office from New York City to the factory at Jersey City, N. J.

The Marion Steam Shovel Co., Marion, Ohio, is planning large additions to its machine shops, erecting department and other parts of the plant. The new steel foundry is now in operation.

The Sargent-Hollingshead Co., Fisher building, Chicago, which was incorporated last August to manufacture and sell railway equipment and supplies, has increased its capital stock from $5,000 to $10,000.

The Knight Pneumatic Sander Co., Huntington, Ind., has been incorporated to manufacture a pneumatic sander for railway service. The directors are William F. Yergens, Charles E. Knight and G. F. Knight.

The New Castle Forge & Bolt Co., New Castle, Pa., has increased its capital stock from $300,000 to $450,000 to provide additional working capital. No large additions or improvements are planned at present.

The Ralston Car Works, Ralston, Neb., has been incorporated with a capital of $300,000 by C. A. Ralston, Fisher building, Chicago; George T. Ross, M. S. Dean, W. J. Lacey, William Hassman, H. H. Baldridge and L. Howard.

The Railroad Appliance Co., Columbia, S. C., has been incorporated to make patented railway devices. Alexander Rowland is President and Treasurer; Lysander D. Childs, M.E., Vice-President; James B. Edwards, General Manager, and F. C. Hack, Secretary.

The Spiral Journal Bearing Manufacturing Co., St. Louis, Mo., has been incorporated to manufacture and sell railway journal bearings and supplies. Capital stock, $200,000. The incorporators are George J. Kobusch, W. S. McCall, Abraham Cook and W. B. Phelps.

An American consular officer of Latin America says that an official of a local railway wants catalogues and price lists of railway and river steamboat materials and supplies, including machine tools, rails, cars, etc. (Inquiry No. 3,071, Bureau of Manufactures, Washington, D. C.)

Alexander B. Wetmore has been appointed Sales Manager of the Monarch Steel Castings Co., Detroit, Mich., effective March 1. Mr. Wetmore leaves a long period of service with the Detroit Lubricator Co., Detroit, to take up the sales of the Monarch couplers and Monarch graduated draft gear.

Another British patent has been revoked under the new patent law. It is that of an American sewing machine, the patentees having taken no steps to comply with the law requiring manufacture in England. They had to pay $200 costs to the applicants who asked for the revocation of the patent.

Bids will be received until March 8, 1909, by the Isthmian Canal Commission, Washington, D. C., for furnishing the following: Rail braces, dipper doors for steam shovels, band saws, twist drills, pipe chucks, bridge reamers, hand jointer knives, belt studs, carborundum wheels, etc. (Circular No. 495.)

The Marshall & Huschart Machinery Co., Chicago, made a formal opening of its demonstration room, at 62 South Canal street, on Saturday evening, February 20. The Superintendents' and Foremen's Club of the Chicago branch of the National Metal Trades Association held its regular meeting in the store room on the same evening.

According to a consular report, tenders for the construction of an American steel bridge, to the order of the Japanese Government Railways, were opened recently, resulting in favor of Frazer & Sale. The amounts of the tenders were as follows: Frazer & Sale, $74,270; Mitsui Bussan Co., $74,490; American Trading Co., $76,500; Okura & Co., $78,228; Nishizawa Co., $78,750.

The Blue Island Car & Equipment Co., Chicago, has purchased a 10-in. and an 18-in. merchant bar mill, with shear and miscellaneous equipment, from the United Engineering & Foundry Co., Pittsburgh, Pa. This machinery will be in-

stalled in a new rolling plant that will be operated in connection with its other manufactures at West Pullman.

The plant, business and good will of the John Davis Co., Chicago, manufacturer of cast iron pipe and fittings, which has been in existence for 40 years, has been sold to the National Tube Co., Pittsburgh, Pa., with the exception of the "Eclipse" steam specialties. These will continue to be made and sold by the Hughson Steam Specialty Co., 860 South Halstead street, Chicago, agent for the Byers wrought iron pipe.

The Northern Pacific is installing electric lights on all its main line passenger trains. Curtis turbo-generating outfits, instruments, etc., have been bought from the General Electric Co., Schenectady, N. Y. The apparatus will probably be used in conjunction with storage batteries and other auxiliary devices. One train running between St. Paul, Minn., and Portland, Ore., has been lighted with this system for several years.

Olaf Hoff, M. Am. Soc. C. E., has opened an office as consulting engineer at 149 Broadway, New York. He will give special attention to the design of bridges, foundations, subaqueous tunnels, subways and other structures, making examinations and reports and directing new construction. Mr. Hoff was formerly Engineer in charge of bridges and buildings of the New York Central & Hudson River and was later Vice-President of the Butler Bros.-Hoff Co., New York.

Among the recent orders taken by the Crocker-Wheeler Co., Ampere, N. J., is one for a 250-kw. motor generator set for the Tennessee Coal, Iron & Railroad Co., at Ensley, Ala. It will consist of a 250-kw., 275-volt d.c. generator, driven by a 6,600-volt, three-phase, 25-cycle, synchronous motor, and will be used as an exciter. Another order is one for about 50 h.p. of small elevator motors, purchased by the Haughton Elevator & Machine Co., Toledo, Ohio. Yawman & Erbe, Rochester, N. Y., have also placed orders for a number of 2/5 h.p. motors for use on some of their specialties.

Harry Vissering, who for the past ten years has been General Sales Agent of the United States Metallic Packing Co., Philadelphia, Pa., and Superintendent of the American Locomotive Sander Co., Philadelphia, has resigned to devote his entire time to the interests of the Charles R. Long, Jr., Co., Louisville, Ky., in the capacity of Vice-President. The Charles R. Long, Jr., Co., manufacturer of railway paints, has just purchased a plot of ground in Louisville, having a frontage of 150 ft. and 300 ft. long, upon which it will erect in the near future a thoroughly up-to-date paint plant to cost about $100,000. Mr. Vissering will continue to make his headquarters in the Great Northern building, Chicago.

On January 29, during the week the sales organization of the Western Electric Co., Chicago, held its conference in Chicago, some of the old employees of the Chicago organization gathered at luncheon. Those who attended, and the dates they entered the employ of the company, are as follows:: E. W. Bennett, 1874; J. C. Cannon, 1877; F. B. Uhrig, now Western District Supervisor of the company, with office at Kansas City, 1881; D. L. Harmon, now a banker at Indiana Harbor, Ind., 1883; C. D. Wilkinson, Manager of the Minneapolis house, 1886; William Carpenter, of the Walworth & Neville Manufacturing Co., 1887; Rolo C. Hearsley, 1888, and E. S. Holmes, now Manager of the Indianapolis house, 1890.

The plan of reorganization of the Southern Steel Co., Birmingham, Ala., has been declared operative. The company was put in the hands of receivers in October, 1907, the condition of the money market making this step necessary. Early in 1908 the company was turned over to a board of trustees. The funded debt of the company and its constituents amounts to $6,154,000. These bonds, together with note issues, are ultimately to be converted to a first refunding mortgage issue of $10,000,000. The outstanding common stock, $15,000,000, is reduced to $10,000,000 and the outstanding $10,000,000 7 per cent. cumulative preferred is reduced to $7,000,000 6 per cent. non-cumulative preferred. General creditors receive 50 per cent. in new bonds and 75 per cent. in preferred stock.

The annual report of the Chicago Pneumatic Tool Co., Chicago, for the year ended December 31, 1908, shows profits of $289,625. Depreciation, repairs and renewals cost $92,000. The balance carried to surplus after fixed charges was $21,500. The surplus at the end of 1907 was $1,008,000, and of this, $208,000 had been deducted for additional working capital for foreign subsidiary companies, other extraordinary expenses, and reserves. The present surplus, including the 1908 balance, is $821,500. The amount of the company's sales was reduced 45 per cent. by the depression, which especially affected the iron and steel business. During the year, the stock of goods on hand was reduced about $140,000, and accounts receivable decreased in proportion to the lessened volume of business. Mortgage debt, accounts and vouchers payable and bills payable were reduced $167,000.

Four new motor cars for the Southern Pacific, recently built by the McKeen Motor Car Co., Omaha, Neb., left Omaha on February 13, on their own wheels and under their own power, coupled together, en route to Sacramento, Cal., where they will go into service on the branch and interurban lines of the Southern Pacific. These are the McKeen standard, all-steel, 55-ft., 200 h.p. gasolene motor cars, having a seating capacity of 75 passengers each. This makes a total of 13 motor cars and 10 trailers now in use on that road. The third motor car for the Los Angeles & San Diego Beach is almost finished and will be shipped this week on its own wheels and under its own power to San Diego, Cal. A new 70-ft. motor car which has just been completed for the Bellingham Bay & British Columbia will be shipped in like manner about the first of March to Bellingham, Wash.

The American Automatic Stoker Co., 213 Railway Exchange, Chicago, which, as previously reported, has been organized to manufacture and sell the Strouse locomotive stoker, has opened offices in Chicago and in the Park Row building, New York. The company has one of its stokers on exhibition in the engine room of the Auditorium Annex, Chicago, where the machine may be seen in operation. One of its stokers is also on exhibition in the Railway Exchange building. They were described in the *Railroad Age Gazette* of February 5, 1909, page 255. The officers of the company are: President, D. W. Ross; Vice-President, J. J. Hannahan; Secretary and Treasurer, W. L. Pepperman; Mechanical Engineer, C. A. Street. Mr. Ross, who is also Vice-President of the Interborough Rapid Transit Co., New York, will be at the head of the company and in charge of the New York office. Mr. Hannahan, who was formerly Grand Master of the Brotherhood of Locomotive Firemen and Engineers, will be in charge of the Chicago office. Mr. Street was formerly associated with the Power Station Department of the Commonwealth Edison Co., Chicago.

TRADE PUBLICATIONS.

Pneumatic Tools.—Folders describing Thor hose couplers, air hose, air hammers, drills, wood boring machines and other pneumatic tools, are being distributed by the Independent Pneumatic Tool Co., Chicago.

Locomotive Cranes.—Bulletin No. 35, just issued by The Browning Engineering Co., Cleveland, Ohio, contains a complete description of Browning locomotive cranes, including a number of photographs showing these cranes in operation.

West Indies and Central America.—The United Fruit Co. issues an admirable tourist and motor guide to Jamaica, which it sells for 25 cents; and also other interesting literature on Jamaica and Central America, for which there is no charge.

Engineering Course.—The American School of Correspondence, Chicago, is making a special offer until March 10, of its Cyclopedia of Engineering. The Cyclopedia is compiled from the regular courses and arranged especially for a practical reference library.

Chicago & North Western.—The Belle Fourche government irrigation project in South Dakota is well described in a pamphlet recently issued by the Chicago & North Western. The climate, soil, water supply, cost, crops, market, etc., are all treated in detail.

Chicago, Milwaukee & St. Paul.—"California Winter's Summer Garden," is made the subject of a handsome, five-color brochure just issued by the Chicago, Milwaukee & St. Paul. The diversions found by the tourist and health seeker in Cali-

fornia and information as to hotels, tourists' service, etc., are briefly described.

Small Tools.—The Standard Tool Co., Cleveland, Ohio, has just issued catalogue No. 16, which is a very complete one on the small tools which the company manufactures. The endeavor has been to make this catalogue as complete as possible in price lists, display of the principal goods manufactured by this company and tables of data interesting and valuable to users of small tools.

Air Compressors.—Catalogue A.A. 37 of the Ingersoll-Rand Co., New York, contains a summary of the distinctive features of Class "A.A.-2" air compressors. This summary is arranged in brief but complete form for the use of busy readers. The catalogue also contains valuable information presented as discussions of the important considerations in air compressor design and performance.

Generators.—Bulletin No. 110, just issued by the Crocker-Wheeler Co., Ampere, N. J., contains a list, covering 15 pages, of the names and addresses of companies and individuals using engine type d.c. generators made by this company. Industrial plants, steam and street railways, machine shops, office buildings, etc., are included in this list. An accompanying leaflet contains an index of bulletins from No. 70 to No. 109 inclusive.

Gasolene Motor Cars.—A 50-page catalogue having to do with the gasolene motor cars, and freight and passenger trailers to be used in the same service, has just been issued by the McKeen Motor Car Co., Omaha, Neb. A two-page article, descriptive of the McKeen car, being a reprint from the *Railroad Age Gazette* of January 15, accompanies the catalogue. The special features of this type of car are given in detail, with photographs and drawings showing the exterior, interior and floor arrangements of the various designs. A list of some of the services now established by different roads and a number of testimonial letters from prominent railway officers are incorporated in the publication.

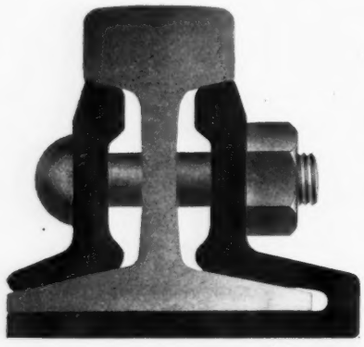
Steel Castings.—The Commonwealth Steel Co., St. Louis, Mo., has issued a number of folders that concisely call attention to the essential features of some of its steel castings. These include its locomotive tender frame, combining all sills, body bolsters, needle beams and other parts into one single casting; pilot beams and tender bumpers; composite underframes for passenger cars; four and six-wheel passenger trucks. One of the folders shows a picture of an unbroken turning of steel 40 ft. 2 in. long that was recently taken off a Commonwealth casting, which if straightened out would make a continuous strip of steel over 90 ft. long, showing that the casting was of solid, tough steel. Blue prints and full information may be obtained from the company upon request.

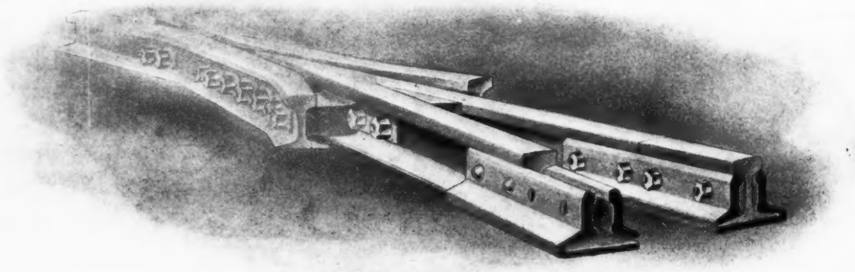
Blake Calling Apparatus.

The Blake Signal & Manufacturing Company, 246 Summer street, Boston, is to exhibit its standard railway signaling apparatus at the Coliseum, Chicago, March 15-20, on the occasion of the meetings of the Railway Signal Association and the American Railway Engineering and Maintenance of Way Association. The spaces reserved by the company are numbers 142 and 143. The Blake apparatus for calling and for controlling semaphore signals at a distance, which has been in use for five years on electric railways, has been adapted for calling on telephone lines, and its use for this purpose on train despatchers' lines will be demonstrated at Chicago. With the Blake apparatus, both visual and audible "calls" can be produced at the stations along the line. The company proposes also, where desired, to set the train-order signal to display stop, even before the operator responds to the call. In the Blake system a separate wire is used for the calling circuit, thus avoiding any overloading of the telephone line and simplifying the work of discovering troubles in the lines. The Blake apparatus, as is well known, is simple in its details, depending on the varying time of vibration of pendulums of different lengths, a different pendulum being assigned to the calling of each station. Experience with the apparatus on electric railways has shown it to be reliable and economical.

Continuous Frog and Switch Joint.

The Rail Joint Co., New York, is just putting on the market a modified type of its Continuous rail joint. The usual Continuous joint has horizontal flanges extending outward from the base of the rail, making the joint too wide at the base to apply conveniently to frog and switch joints, as these joints occur on converging rails close to their points of meeting. The new type, as the illustrations show, retains the particular advantages of the Continuous joint, giving base support and consisting of but two parts aside from the bolts. The development of the new joint has taken some time because of the hard problem of designing rolls to make it. These difficulties have been surmounted, however, the new joint requiring only two more passes than the usual Continuous joint; and the price has not been increased. After trying it out during the past year on several railways, the company is now putting it on the market.





Continuous Frog and Switch Joint.

Westinghouse-Leblanc Condensers.

A number of contracts have been closed during the last six months for Westinghouse-Leblanc condensers, most of which are in connection with new turbine equipment. The Narragansett Electric Light Co., Providence, R. I., is installing two units, 7,000-h.p., in connection with new turbine equipment. The B. F. Goodrich Rubber Co., Akron, Ohio, has ordered one unit in connection with a new turbine for its central power plant. Heretofore most of the experience of this company has been with the surface type condenser in connection with Westinghouse turbines. The Coronet Phosphate Co., Plant City, Fla., has ordered three units for use also in connection with turbines, and the Portland Cement Co., Trinidad, Colo., one unit. Likewise the City of Logansport, Ind., and the Bristol (Tenn.) Gas & Electric Co. Other equipments are being built for the Jersey Central Traction Co., the Washington & Mt. Vernon Railway, in connection with its new turbine plant; and the Cleveland Electric Co. This equipment is about to go in service.

The Westinghouse-Leblanc condenser is compact and maintains high vacuum with limited supply of cooling water. Upon repeated tests it has been able to operate within from 1 to 5 degrees difference between the temperature corresponding to the exhaust steam and that of the cooling water discharge. This represents an efficiency of the condenser of 96 to 99 per cent. These results are obtained by the method of handling the entrained air and are particularly effective in cases of high cooling water temperature, 80 to 85 degrees. They also favor the employment of cooling towers in connection with the condensing plant, reducing the quantity of water to be pumped and increasing the effectiveness of the cooling tower surface by delivering water to the tower at the highest possible temperature.